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TOWARD A UNIFIED ONTOLOGY OF TRUSTED IDENTITY IN CYBERSPACE

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ABSTRACT

The nation's digital infrastructure is in jeopardy because of inadequate provisions for privacy, identity, and security. Recent Internet activity has resulted in an onslaught of identity theft, fraud, digital crime, and an increasing burden to responsible citizens. The computer security and Internet communities have been generally responsive but apparently ineffective, so it is time for a third party to step in, take charge, and provide an infrastructure to assist in protecting individuals and non-person entities. This paper is a contribution to the domain of ontological commitment as it applies to a description of subjects, objects, actions, and relationships as they pertain to the National Strategy for Trusted Identity in Cyberspace initiative.

KEYWORDS: Identity, trusted identity, identity management, cyberspace, Internet, ontology.

INTRODUCTION

The nation's digital infrastructure is in jeopardy because of inadequate provisions for privacy, identity, and security. The "everyone is free to do anything" mentality that would appear to be prevalent in America and worldwide has resulted in an onslaught of identity theft, fraud, digital crime, and an unnecessary concern over cyber security by many individuals. It is patently necessary for careful participants to operate defensively in cyberspace in order to protect themselves from the evils just mentioned. Those that do not use the Internet responsibly do so at their own peril. In fact, digital crime has served as a precursor to and is associated with physical crime. (OECD 2008)

An essential component of secure transactions in cyberspace is effective identity management, to which the computer security and Internet communities have been generally responsive but essentially ineffective. It is time for a third party to step in, take charge, and provide an infrastructure to assist in protecting the citizens of the world. (White House 2010) Similar concerns prevail in other developed countries. Many cyber crimes are perpetrated from lesser-developed countries that do not possess cyber awareness from legal, political, economic, and technical perspectives, but nevertheless provide a basis for illegal activity. There is no good reason why developed countries should have to resort to extreme measures to protect their domain, lending credence to the idea that a globally accepted form of identity determination would be appropriate. The framework for a cyber ecosystem, presented here, is purported to be a lynchpin in the development of identity management systems designed to facilitate a secure Internet.

This paper is a contribution to the domain of ontological commitment as it applies to a description of subjects, objects, actions, and relationships as they pertain to the National Strategy of Trusted Identity in Cyberspace initiative. The initial section, entitled "Major Issues," supplies a context for the ontology of trusted identity.

MAJOR ISSUES

Most of the activities present in modern society are orchestrated by two fundamental concepts: rules and roles. There are rules for just about everything we do. There are rules of the road, rules of engagement, rules of law, rules of social behavior, rules of dress, and so forth. A subject applies certain rules in accordance with the roles adopted for a specific formal or informal interaction.

The adoption of particular roles is governed by authorization. A subject is authorized to address a task or perform a requisite function through informal social structures, a formal delegation, credentials, or certified identity. We are going to apply the rule/role paradigm to the development of an identity ecosystem for transactions in cyberspace.

Identity

Identity is a means of denoting an entity in a particular namespace and is the basis of security and privacy – regardless if the context is digital identification or non-digital identification. We are going to refer to an identity object as a *subject*. A subject may have several identities and belong to more than one namespace. A pure identity denotation is independent of a specific context, and a federated identity reflects a process that is shared between identity management systems. When one identity management system accepts the certification of another, a phenomenon known as “trust” is established. The execution of trust is often facilitated by a third party that is acknowledged by both parties and serves as the basis of digital identity in Internet processing and other computer services. Access to computing facilities is achieved through a process known as authentication, whereby an entity makes a claim to its identity by presenting an identity symbol for verification and control. Authentication is usually paired with a related specification known as authorization to obtain the right to address a given service.

Authentication

Authentication is a complex issue that affects the following classes of user accessibility in an Internet environment:

1. A user that logs on to a single computer application.
2. A user that logs on to a computer application that links to another computer application that requires authentication.
3. A user that logs on to a computer application hosted by a service provider that deploys the application using a multi-tenant service model.

In the first instance, the end user would then have to log on to the local computer and then log on to the application at the service platform running in cyberspace. This is typically the case with consumer-oriented cloud-computing services and customer-developed application software. When the application requires an additional sign-on, it must maintain its own user accounts – a process known as *delegated administration*. This instance is depicted in Figure 1. When authentication requires a sign-on to an enterprise system running on the cloud and then on to a specific application, a multiple sign-on would ordinarily be required. With a trusted authentication system, as suggested by Figure 2, the user would sign-on to an authentication server that would issue a token accepted by a federated server as proof of identity, required by specific applications. A service provider with thousands of customers would prefer a trusted solution in lieu of establishing a trust relationship with each of its customers. Common authenticators are something you know, something you have, something you are, and where you are, or in many cases, a combination of the authenticators.

One of the major problems in cyberspace, how do you know with whom you are interacting? With trusted authentication, a trusted authority validates the physical identity of subjects and objects, and binds physical entities with digital identities. Trusted authentication is designed to minimize the risk of identity spoofing and masquerading.

Authorization

Typically, *authorization* refers to permission to perform certain actions. In cloud computing, users are assigned roles that must match corresponding roles associated with a requisite SaaS application. Each SaaS application contains a set of roles pertinent to the corresponding business function. Access is further controlled by business rules that specify conditions that must be met before access is granted. The role/business-rule modality also applies to storage in the cloud, and this is where the practice of privacy kicks in.

In general, the combination of identification and authentication determine who can sign-on to a system – that is, who is authorized to use that system. Authorization, often established with access control lists, determines what functions a user can perform. A related measure, known as accountability, records a user’s actions. Authorization cannot occur without authentication.

In general, there are two basic forms of access control: discretionary access control, and mandatory access control. With discretionary access control (DAC), the security policy is determined by the owner of the security object. With mandatory access control (MAC), the security policy is governed by the system that contains the security object. Privacy policy should, in general, be governed by both forms of access control. DAC reflects owner considerations, and MAC governs inter-system controls.

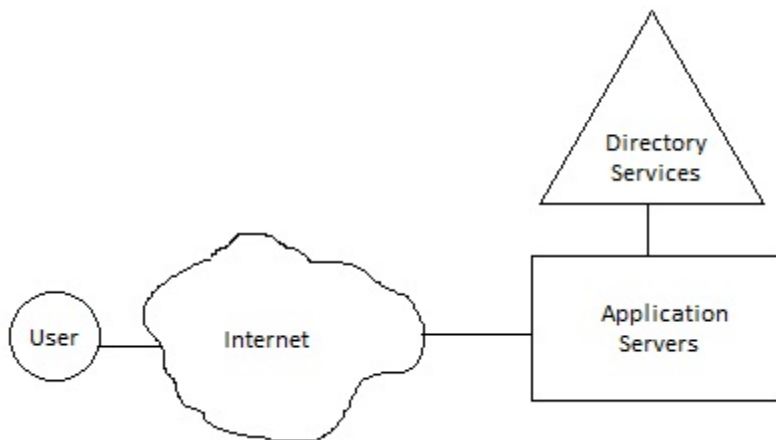


Figure 1. Delegated administration.

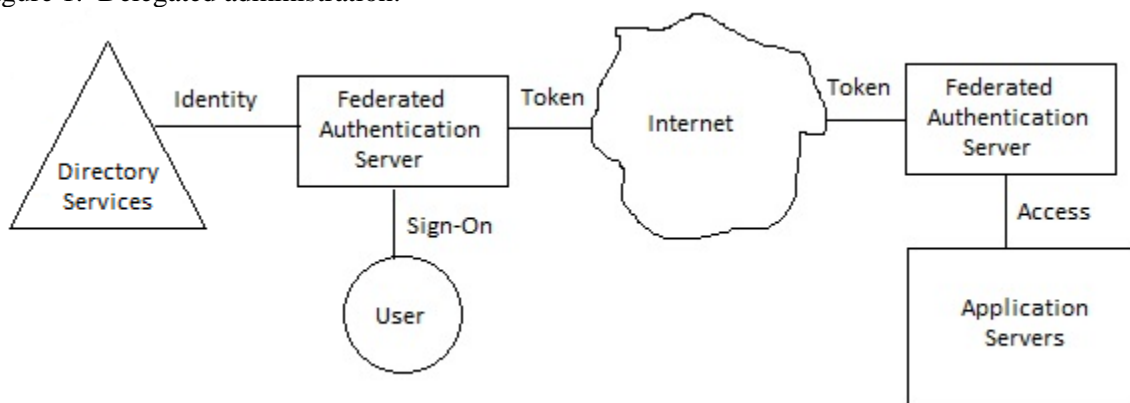


Figure 2. Trusted authentication system.

Accountability

Accountability is determined by audit trails and user logs that are prototypically used to uncover security violations and analyze security incidents. In the modern world of computer and information privacy, accountability would additionally incorporate the recording of privacy touch points to assist in managing privacy concerns. Although the Internet is a fruitful technology, it garners very little trust. Why? It is very cumbersome to assign responsibility for shortcomings and failure in an Internet operational environment. Failure now takes on an additional meaning. In addition to operational failure, it is important to also include “failure to perform as expected,” as a new dimension.

Trustworthy Computing

Trustworthy computing refers to the notion that people in particular and society as a whole can trust computers to safeguard things that are important to them. Medical and financial information are cases in point. Computing devices, software services, and reliable networks are becoming pervasive in everyday life, but the lingering doubt remains over whether or not we can trust them. Expectations have risen with regard to technology such that those expectations now encompass safety, reliability, and the integrity of organization that supply the technology. Society will only accept a technological advance when an efficient and effective set of policies, engineering processes, business practices, and enforceable regulation are in place. We are searching for a framework to guide the way to efficacy in computing.

As with many utilities, trustworthy computing should be intuitive, controllable, reliable, and predictable. In order to achieve these lofty goals, we are going to look to the framework developed at Microsoft (Mundie 2002) consisting of goals, means, and execution. The set of *goals* reflects a subject’s perspective and is comprised of security, privacy, reliability, and business integrity considerations. The set of *means* refers to the computer industry’s viewpoint and includes secure-by-design, secure-by-default, secure-in-deployment, fair-information principles, availability, manageability, accuracy, usability, responsiveness, and transparency. *Execution* concerns the manner in which an organization does business and includes intent, implementation, evidence, and integrity. One approach to using the framework is through the concept of a *trusted stack* constructed from five important elements: secure hardware, a trusted operating system, trusted applications, trusted people, and trusted data. (Charney 2008)

Ontology

Ontology is a specification of “what is.” In philosophy, use of the term reflects the study of being (or existence) and describes and delineates a collection of basic categories, and defines the entities and classes of elements within a category. In service science, ontology is a specification of a conceptualization used to enable knowledge sharing. Since ontology concerns existence, an ontological definition of a subject – perhaps a service category – reflects a materialization of a concept obtained through a shared reality, and not what it is called or how it is made or used. In this paper, the definition of ontology, as “a set of representational primitives with which to model a domain of knowledge or discourse,” will be adopted. (Gruber 2008, Wikipedia 2009a) More specifically, ontology can be viewed as a data model that describes objects, classes, attributes, and relations.

One common approach to the delineation of ontological elements is to divide the extant entities into groups called “categories.” These lists of categories can be quite different from one another. It is in this latter sense that ontology is applied to such fields as theology, service science, and artificial intelligence. (Wikipedia 2009) In the naming of ontological elements, it is important to note that there are two approaches to the use of nouns. In one philosophical school, nouns should refer to existent entities. In

the alternate school, nouns are used as a shorthand as reference to a collection of object or events. For example the word *mind* would refer to a collection of mental states, and *society* would refer to a collection of people.

Ontological engineering encompasses a set of activities conducted during conceptualization, design, implementation, and deployment of ontologies. (Dedvedzic 2002) Ontological engineering seeks to achieve the following goals in a given domain:

- Definition of terms
- Establishment of a body of domain knowledge
- Specification of coherent and expressive knowledge bases

In short, ontology defines the vocabulary of a problem domain and a set of constraints on how terms are related. It also gives data types and operations defined over the data types.

Most forms of ontology are expressed in an ontology language and share structural similarities, such as individuals, classes, attributes, relations, function, restrictions, rules, axioms, and events. The basic idea behind ontology languages is to allow software agents to communicate in a knowledge intensive computer-based environment: We are going to concentrate on the following components: (Guarino 1995)

- Individuals* referring to instances and objects
- Classes* expressed as sets, collections, and kinds of things
- Attributes* giving features and characteristics of individuals and classes
- Relations* that determine ways that individuals and classes relate

The components determine whether a specific ontology is a domain ontology or an upper ontology. In a *domain ontology*, a specific type would be relevant to particular category, such as in a medical or household category. In an *upper ontology*, a type would be applicable to all ontologies in the universe of discourse. In the service ontology, presented in the following section, we are going to be developing an upper ontology for trusted identity in cyberspace.

Security Categorization

Security categorization of information and information systems is a means of establishing a framework for information management and assessing operational risk of inherent entities. (FIPS 2004) Three security objectives are identifies:

- Confidentially
- Integrity
- Availability

Confidentiality refers to the preservation of restrictions on information access and disclosure. Alternately, a loss of confidentiality is the unauthorized disclosure of information. *Integrity* refers to controls that prevent improper information modification and destruction. Alternately, loss of integrity is the unauthorized modification or destruction of information. *Availability* refers to the insurance of timely and reliable access to the use of information. Alternately, loss of availability is the disruption of access or use of information or an information system. (FIPS op cit.)

The loss of confidentiality, integrity, or availability is known as the *potential impact* resulting from a breach of security. Impact assessments can be classified as low, moderate, or high. The potential impact is low if a loss of integrity, integrity, or availability would have limited adverse effect on a corresponding

organization, asset, or individual. The potential impact is moderate if a loss of integrity, integrity, or availability would have serious effect on a corresponding organization, asset, or individual. The potential impact is high if a loss of integrity, integrity, or availability would have severe or catastrophic adverse effect on a corresponding organization, asset, or individual.

The synthesis of an **OBJECTIVE** × **IMPACT** grid for a specific unit of information or an information system would provide a measure of security for that entity. (FIPS op cit)

Risk Management

Risk management is a process to protect an organization and its ability to perform its mission and protect its assets. Defined informally, *risk* is the net negative impact of a loss of confidentiality, integrity, or availability. It follows that risk management is the process of identifying risk, assessing risk, and taking steps to reduce risk to an acceptable level. (Stoneburner 2002)

Risk management incorporates the processes of risk assessment, risk mitigation, and risk evaluation and assessment. (Stoneburner op cit.) A formal definition of risk is:

Risk is a function of the **likelihood** of a given **threat-source's** exercising a particular potential **vulnerability**, and the resulting **impact** of that adverse event on the organization. (Stoneburner op cit, p. 8)

Three preliminary methods of assessing risk are system characterization, threat identification, and vulnerability identification. Trusted identity is a significant aspect of risk mitigation in information systems.

UPPER ONTOLOGY FOR TRUSTED IDENTITY

The ontology of trusted identity is a developmental artifact for the study, design, analysis, and application of governance to the complex subject of digital identity in an interdependent network of information technology components. Essentially, an identity ecosystem is required to tie the elements together, so that they are applicable to a wide range of operational scenarios. (White House 2010) The primary measure of an ontological determination is how it assists in delineating the value chain for trusted identity services, comprised of people, technology, and organizations, and its relevance to education, government, business, and other social phenomena. This ontology is distinct from and runs orthogonal to the ontology for identity credentials developed by the National Institute for Standards and Technology (NIST) and published in 2006. (MacGregor 2006)

Chain of Trust Scenario for Credential Determination (Example)

The basis of digital identity in a networked environment is a credential determined by a trusted source, where *credential*, in this instance is defined as an assertion about a subject issued by a trusted authority. Figure 3 gives a very simple example of a chain of trust for the issuance of a driver's license. The trusted elements in the example are the hospital and the DMV.

While a driver's license might not be the best example, because it is a repurposed document serving as a government issued form of identification containing superfluous information, it does demonstrate the process of binding a personal identity with a physical artifact. Issuance of the license by the DMV (Department of Motor Vehicles) is an example of "identity proofing" and of the "governance" of a trusted authority, implicit but not mentioned in the scenario.

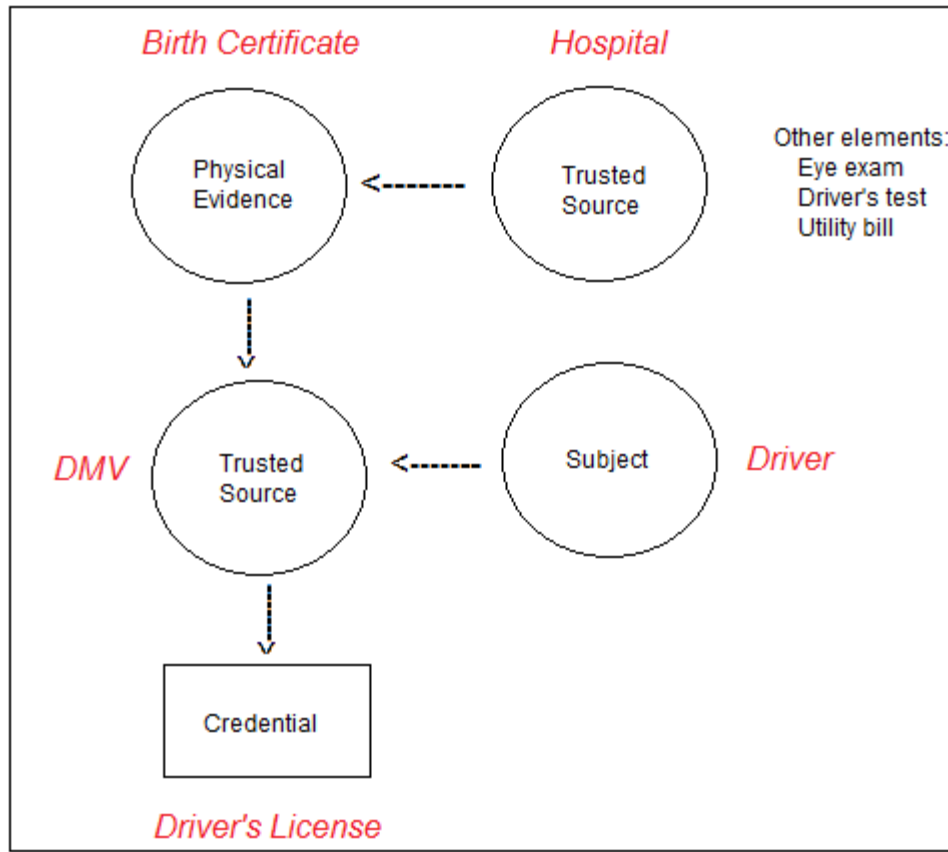


Figure 3. Chain of trust scenario.

Authentication Model

In the trusted authentication model, subjects are sponsored by a Granting Authority, perhaps the subject itself, to enroll with a Registration Authority as a Subscriber of a trusted service protected by a Credential Service Provider. The process is known as Registration whereby the subject, after being subjected to an Identity Proofing, is issued a Token, representing a binding between the subject and an authentication secret. Authentication factors, reflected in a Token, are one or more of the following:

- Something the subject knows
- Something the subject has
- Something the subject is

Categories of relevant identity documents of this genre are covered in the next section.

During the operation of a trusted authentication system, a prospective user, known as a Claimant, presents the token to Verifier for access to a protected service. The Verifier checks with the Credential Service Provider, through an identity registry, for identity verification. If the Claimant is authorized to access the requested transaction, it is registered as a Subscriber and an Assertion is forwarded to the Relying party to instantiate the operation.

The ontological elements presented here are summarized in Table 1.

Table 1. Ontological Elements for Trusted Identity.

<i>Element</i>	<i>Definition</i>
Assertion	A statement from a Verifier to a Relying Party that contains identity information about a Subscriber. Assertions may also contain verified attributes.
Authentication	The process of establishing confidence in the identity of users or information systems.
Authentication Protocol	A defined sequence of messages between a Claimant and a Verifier that demonstrates that the Claimant has control of a valid token to establish his/her identity, and optionally, demonstrates to the Claimant that he or she is communicating with the intended Verifier.
Claimant	A party whose identity is to be verified using an authentication protocol.
Credential	An object that authoritatively binds an identity (an optionally, additional attributes) to a token possessed and controlled by a person.
Credentials Service Provider (CSP)	A trusted entity that issues or registers Subscriber tokens and issues electronic credential to Subscribers. The CSP may encompass Registration Authorities and Verifiers that it operates. A CSP may be an independent third party, or may issue credential for its own use.
Electronic Authentication	The process of establishing confidence in user identities electronically presented to an information system.
Identity	A unique name of an individual person. Since the legal names of persons are not necessarily unique, the identity of a person must include sufficient additional information (for example, an address, or some unique identifier such as an employee or account number) to make the name unique.
Identity Proofing	The process by which a CSP and an RA validate sufficient information to uniquely identify a person.
Registration	The process through which a party applies to become a Subscriber of a CSP and an RA validates the identity of that party on behalf of the CSP.

Registration Authority (RA)	The trusted entity that establishes and vouches for the identity of a Subscriber to a CSP. The RA may be an integral part of a CSP, or it may be independent of a CSP, but it has a relationship to the CSP.
Relying Party	An entity that relies upon the Subscriber's credentials or Verifier's assertion of an identity, typically to process a transaction or grant access to information or a system.
Subject	The person whose identity is bound in a particular credential.
Subscriber	A party who has received a credential or token from a CSP.
Token	Something that the Claimant possesses and controls (typically a key or password) used to authenticate the Claimant's identity.
Verifier	An entity that verifies the Claimant's identity by verifying the Claimant's possession of a token using an authentication protocol. To do this, the Verifier may also need to validate credentials that link the token and identity and check their status.

Source: (Burr 2008), pp. 6-12.

Categories of Credential Documents

Identity credentials identify the issuer and subject and document some qualities or characteristics of the subject, as known to the issuer. (MacGregor 2006, p. 12) Credentials are usually grouped into three categories:

- *Primary identity credentials*, resulting from significant life events, such as birth or marriage.
- *Secondary identity credentials*, issued in response to a request for authorization to perform an action, such as a driver's license.
- *Tertiary identity credentials*, issued by an authority for a limited purpose, such as an employee badge or program loyalty card.
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Table 2 gives a summary of the categories of identity documents.

Table 2. Categories of Identity Documents

<i>Category</i>	<i>Example</i>
Identity	Driver's license Military ID card
Entitlement	Medicare/health enrollment card Veteran's benefit ID card
Privilege	Professional license Voter registration

Travel	Passport Visa
Life event	Birth certificate Marriage certificate
Employment eligibility	Social security card
Employment verification	Company employee ID Military ID
Building access	Company ID card Federal ID card
Citizenship	Passport Certificate of naturalization
Financial/credit	Bank account statement Credit card Vehicle title Property deed
Obligation	Selective service registration Military commission

Source: (MacGregor 2006), pp. 24-25.

Registration

Registration is the first of two major processes that delineate the operation of a trusted identity system. The interactions between the Subscriber, Registration Authority (RA), and the Credentials Service Provider (CSP) are given as follows: (Burr 2008, p. 14)

1. An individual applies to an RA for registration.
2. The RA identity proofs the applicant.
3. On successful identity proofing, the RA send the a registration confirmation message to the CSP.
4. A secret token and a credential are established between the CSP and the new Subscriber.
5. The CSP registers the credential. The Subscriber preserves the token.

In some operational environments, an applicant may require a sponsor or possess membership in an appropriate organization.

Verification

Verification is the second major process in trusted identity, delineated as follows: (Burr 2008, p. 14)

1. The Claimant proves to the Verifier that he or she is in possession of a required token through an authentication protocol.
2. The Verifier contacts the CSP to verify that the token and credential have been confirmed and the Claimant is a Subscriber of the CSP.
3. The Verifier generates an assertion that is sent to the Relying Party to determine access control and authorization specifications.
4. An authentication session is established between the Subscriber and the Relying Party.

The Verifier may not be distinct from the Relying Party. Depending upon the authentication protocol used, special features, such as digital certificates, may obviate communication with the CSP.

Governance

A typical organization has a group of stakeholders who have something to gain of the organization is successful and something to lose of the organization is not successful. The stakeholders, often referred to as *principals*, give the right to manage an endeavor to *agents*, ostensibly qualified to do so and are rewarded accordingly, through the application of policies and rules that represent the principal's best interests. The process is generally known as *governance*. In the domain of trusted identity, governance is primarily concerned with risk management, as introduced earlier.

Risk involves potential harm or impact and the likelihood of such harm or impact. Categories of harm or impact include: (Bolten 2003, p. 5)

- Inconvenience, distress, or damage to standing or reputation
- Financial loss or agency liability
- Harm to agency programs or public interests
- Unauthorized release of sensitive information
- Personal safety
- Civil or criminal violations

Recommended procedures to mitigate risk would necessarily incorporate the following procedures:

1. Conduct a risk assessment of the e-government system.
2. Map identified risks to application assurance level.
3. Select technology based on e-authentication technical guidance.
4. Validate that the implemented system has achieved the required assurance level.
5. Periodically reassess the system to determine technology refresh requirements.

(The terms e-government and e-authentication refer to electronic government and electronic authentication, respectively.)

Finally, and perhaps most importantly, the governance of trusted identity should operate within the 7 laws of identity: (Cavoukian 2010 and Mercuri 2007):

Law # 1: User Control and Consent

Technical identity systems must reveal information identifying a user only with the user's consent.

Law # 2: Minimal Disclosure for a Constrained Use

The solution that discloses the least amount of identifying information and best limits its use is the most stable long-term solution.

Law # 3: Justifiable Parties

Digital identity systems must be designed so the disclosure of identifying information is limited to parties having a necessary and justifiable place in a given identity relationship.

Law # 4: Directed Identity

A universal identity system must support both “omnidirectional” identifiers for use by public entities and “unidirectional” identifiers for use by private entities, thus facilitating discovery while preventing unnecessary release of correlation handles.

Law # 5: Pluralism of Operators and Technologies

A universal identity system must channel and enable the interworking of multiple identity technologies run by multiple identity providers.

Law # 6: Human Integration

The universal identity metasystem must define the human user to be a component of the distributed system integrated through unambiguous human-machine communication mechanisms offering protection against identity attacks.

Law #7: Consistent Experience Across Contexts

The unifying identity metasystem must guarantee its users a simple, consistent experience while enabling separation of contexts through multiple operators and technologies.

A complete description of the 7 laws is given in Mercuri *op cit.*, pp. 37-43.

SUMMARY

The paper is a contribution to the domain of ontological commitment as it applies to a description of subjects, objects, actions, and relationships as they pertain to the National Strategy of Trusted Identity in Cyberspace initiative. Further research would necessarily entail a formal definition of the ontological elements presented in the paper.

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Encryption and Portable Data Storage

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Abstract

The protection of data is key issue in today's world. The wide of availability and use of portable technologies such as USB flash has increased concern about securing the data resides on these devices. Because USB flash drives are small, relatively inexpensive, and easy to use, the security of the information stored on these thumb drives is on-going concern. A number of approaches to safeguarding the information stored on these drives are available. This paper examines one approach to this goal through the use of encryption. This method encrypts all the data on the drive. In addition the fact the data on the drive is encrypted is not visually obvious when viewing the contents of the disk. The proposed approach uses publically available and free encryption algorithms. A user password is needed to view and access the data that has been encrypted. The proposed methodology is quick and easy to use. Individuals who routinely carry around their USB drives need to be able to decrypt and encrypt the device quickly and conveniently. Furthermore, if the device is lost, it is still possible with the method advocated in this paper to include information about how to return the device to the owner without compromising the secured data on the drive. Without encrypting the data on portable drives, the user risks the disclosure of information. This paper argues that portable storage should be secured and suggests a way to secure the data through password and encryption that further enhances the usability and flexibility of the USB flash drive.

The paper includes the results and analysis of an undergraduate student survey that determined what habits and practices they followed with respect to securing their personal data and files. Some of the questions included in the analysis are the following:

- Do you encrypt your USB flash drive?
- Do you use any type of security for your USB flash drive?

- How important do you think security is for a flash drive? (A Likert scale)
- Do you use passwords to protect your USB flash drive?
- Do you backup your work?
- Do you think it is important to use security when using a USB flash drive?

The findings of the survey help to understand the perspective of today's students and how to address the critical need to secure their information and data files with them.

The growing use of portable data storage devices is an accepted reality in today's society (GFI Software, 2010). One type of portable data storage device in common use today is the USB flash drive or thumb drive or memory stick (PCTechGuide, 2009). Because these drives can hold an increasing amount of data and are easily ported from one location to another, many businesses consider them to be their greatest security threat (EzineArticles.com, 2010). McAfee Labs (2010) in its 2010 threats report state:

One of the most active categories of malware this quarter was AutoRun worms (malware found on removable storage, mainly USB drives). Due to the widespread adoption of USB drives by both consumer and enterprise users around the world, this infection vector continues to be a leading source of pain. (p. 11)

This paper suggests an approach to securing the USB flash drive through encryption. In addition to describing this approach, this report conducted a survey to examine perceptions about security and portable storage devices. An analysis of the survey results is also provided. The first of the paper describes the encryption approach for securing USB thumb drives and the second section presents the survey results.

Using Encryption to Secure a USB Flash Drive

Typically flash drives are missing important encryption and authentication safeguards to protect the data (IronKey, 2007). The methods recommended in this report provide encryption and authentication through the use of a password. The solution suggested is the open source software provided by TrueCrypt Foundation (2010b); TrueCrypt's website (www.truecrypt.org) provides complete documentation for the process.

TrueCrypt software has the following advantages:

Creates a virtual encrypted disk within a file and mounts it as a real disk.

Encrypts an entire partition or storage device such as USB flash drive or hard drive.

Encrypts a partition or drive where Windows is installed.

Encryption is automatic, real-time and transparent.

Parallelization and pipelining allow data to be read and written as fast as if the drive was not encrypted.

Encryption can be hardware-accelerated on modern processors.

Provides plausible deniability, in case an adversary forces you to reveal the password.(TrueCrypt Foundation, 2010b)

The step by step procedure for creating an on-the-fly TrueCrypt disk is fully described on their website in the documentation section (TrueCrypt Foundation, 2010a). It worth noting that this approach can also be used on non-USB disk drives to secure other portable and non-portable devices. As an open source solution, the software is free and readily available for download and use. After encrypting a folder on the USB flash, the existence of this folder is not visible and requires a password to mount and unhide the device. If the USB flash drive with TrueCrypt software were lost or stolen, the drive with the secured data would not be visible. The folder with the hidden information can only become visible by mounting the information through a password.

This paper recommends the use of the TrueCrypt solution for securing portable data devices and in particular its use with USB flash drives is essential. This solution provides a versatile approach for safeguarding such devices. In addition, this software is regularly updated to ensure its currency and usability. TrueCrypt is a reasonable answer to both individuals who wish to secure their information as well as organizations that provide portable storage devices to their employees.

The following section of this report provides data about the perceptions of users of portable storage devices in today's world. Although the risks in using unprotected portable storage devices are manifestly clear and a solution through TrueCrypt readily available it is useful to examine behaviors and attitudes toward securing portable storage units because it is these behaviors and attitudes that will ultimately determine the actions that people will take to protect their data.

Perceptions and Attitudes Toward Protecting Portable Storage Devices

To investigate current attitudes toward protecting portable data devices, a survey was administered to 63 undergraduate students in business courses at Marymount University in the Fall 2010 semester. A copy of this instrument is available in Appendix A. The overall results of the survey have been tabulated by question are in Appendix B.

The relationships among the questions used in the survey were analyzed using contingency tables with a phi coefficient to indicate the relationship among the categorical data. Phi is a chi-square based measure of association; the chi-square coefficient depends on the strength of the relationship and sample size. Since phi has a known sampling distribution it is possible to compute its standard error and significance (Howell, 2002). The *PASW 19* package was used for the significance level of the computed phi value. Questions 3 and 5 had no variation in response and were not included in the phi analysis. Question 3 indicated that all participants thought that security was extremely important for a flash drive and Question 5 revealed that all participants backup their work. Consequently contingency were developed for Questions 1, 2, 4, and 6. Each of these questions can be represented by the variable labels listed in Table 1.

Table 1

Questions and Labels

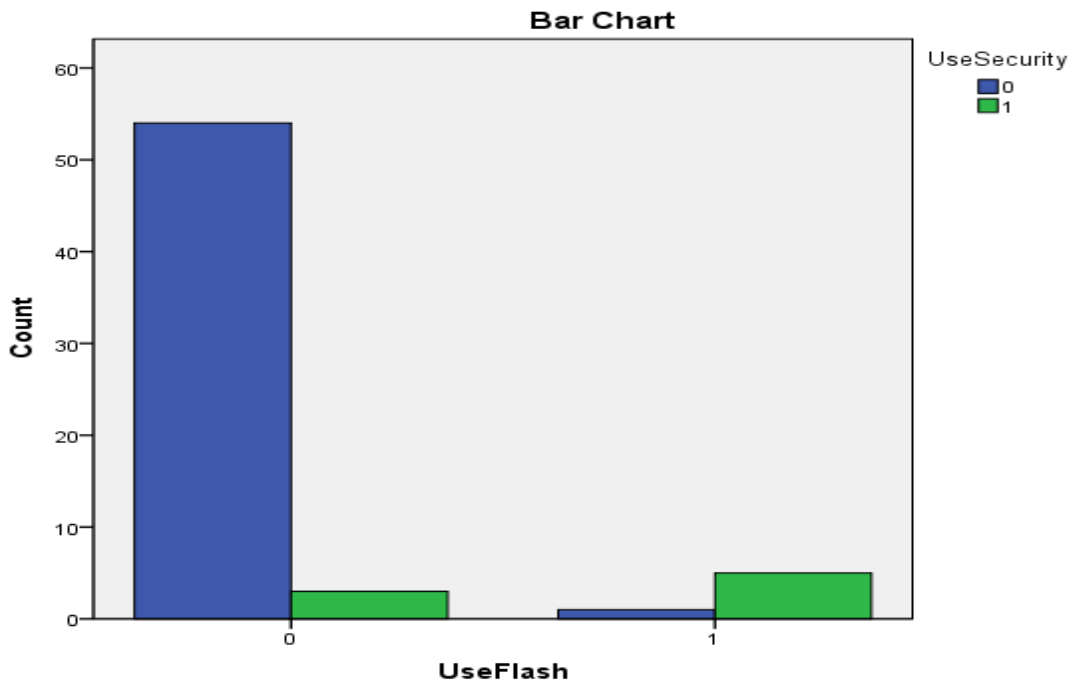
Question Number	Corresponding Variable Label
1	Use Flash
2	Use Security
4	Use Passwords
6	Attitude Toward Security

For this analysis the strength of the association will be assessed through a rule of thumb which provides a range of values for Phi and verbal assessment. Strong negative and strong positive associations are represented by Phi values between -1.0 to -.7 and .7 to 1.0, respectively. Weak negative and positive associations are between -.7 to -.3 and .3 to .7, respectively. Values of Phi indicating little or no association are between -.3 to .3 (Simon, 2005).

Use Flash by Use Security

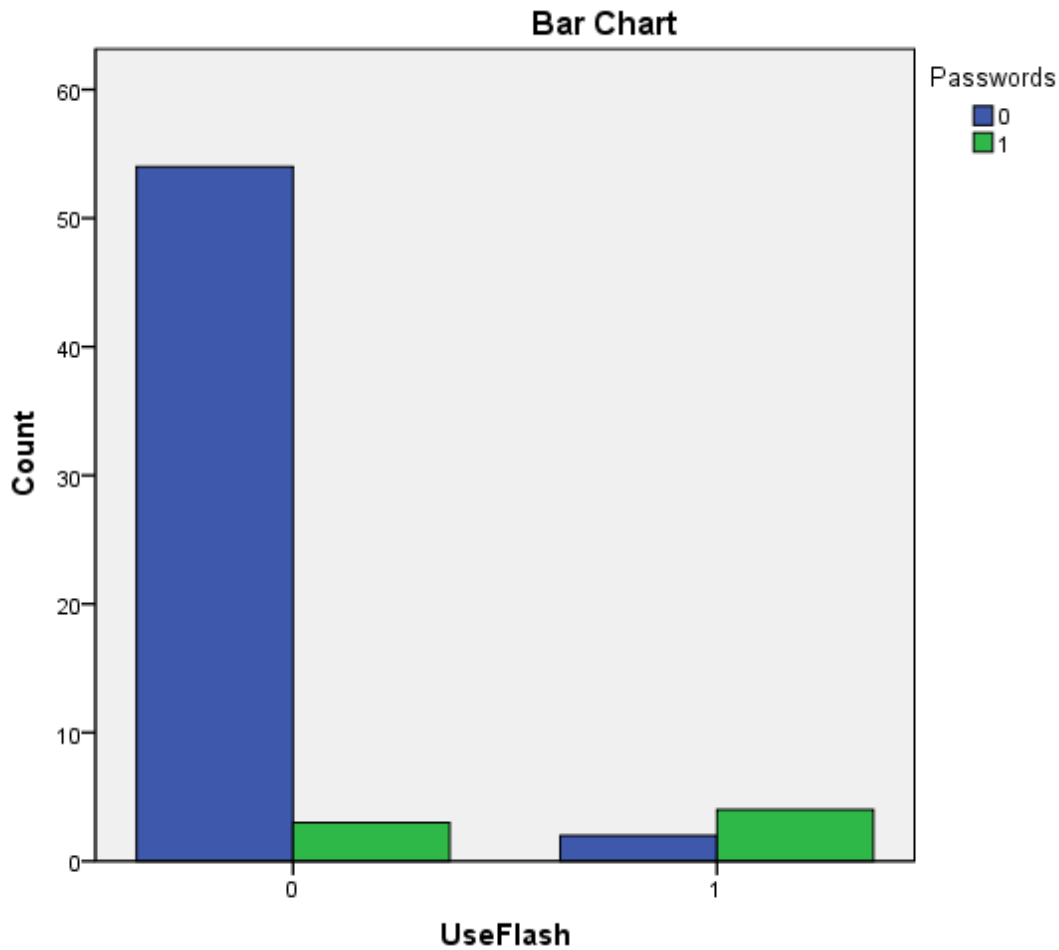
The relationship between using flash and security is provided in Figure 1. The Phi value was .688 and significant at the $p=.05$ level. Using flash security is strongly associated with the use of security.

Figure 1. Use Flash by Use Security



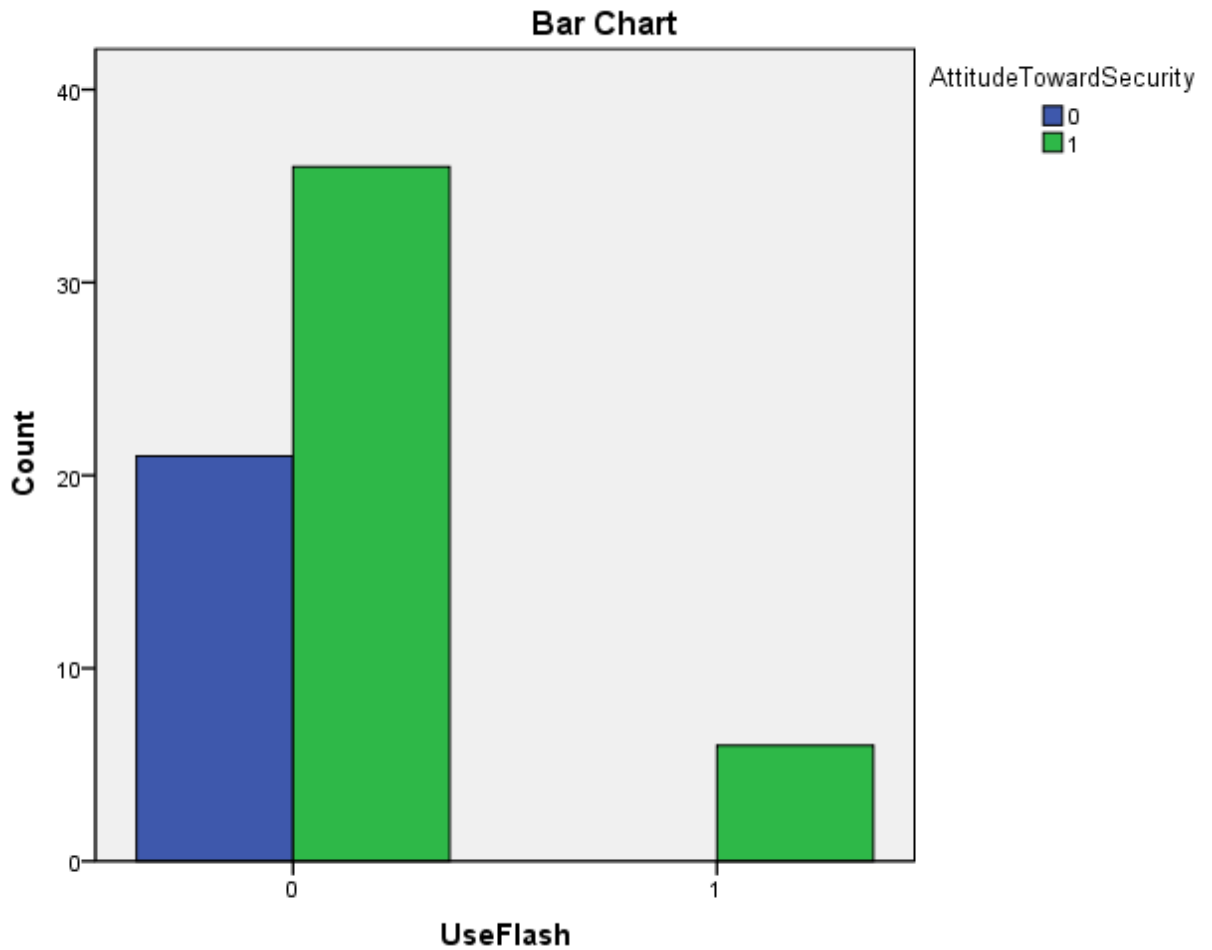
Use Flash by Use Passwords

The association between using flash and using passwords is presented in Figure 2. The Phi value was .574 and significant and the $p=.05$ level. The use of flash is strongly related to the use of passwords.

Figure 2. Use Flash by Use Passwords**Use Flash by Attitude Toward Security**

The relationship between using flash and attitude toward security is presented in Figure 3. The Phi coefficient was .229 and not significant at the $p=.05$. The relationship between using flash drive and the attitude toward security is a weak association.

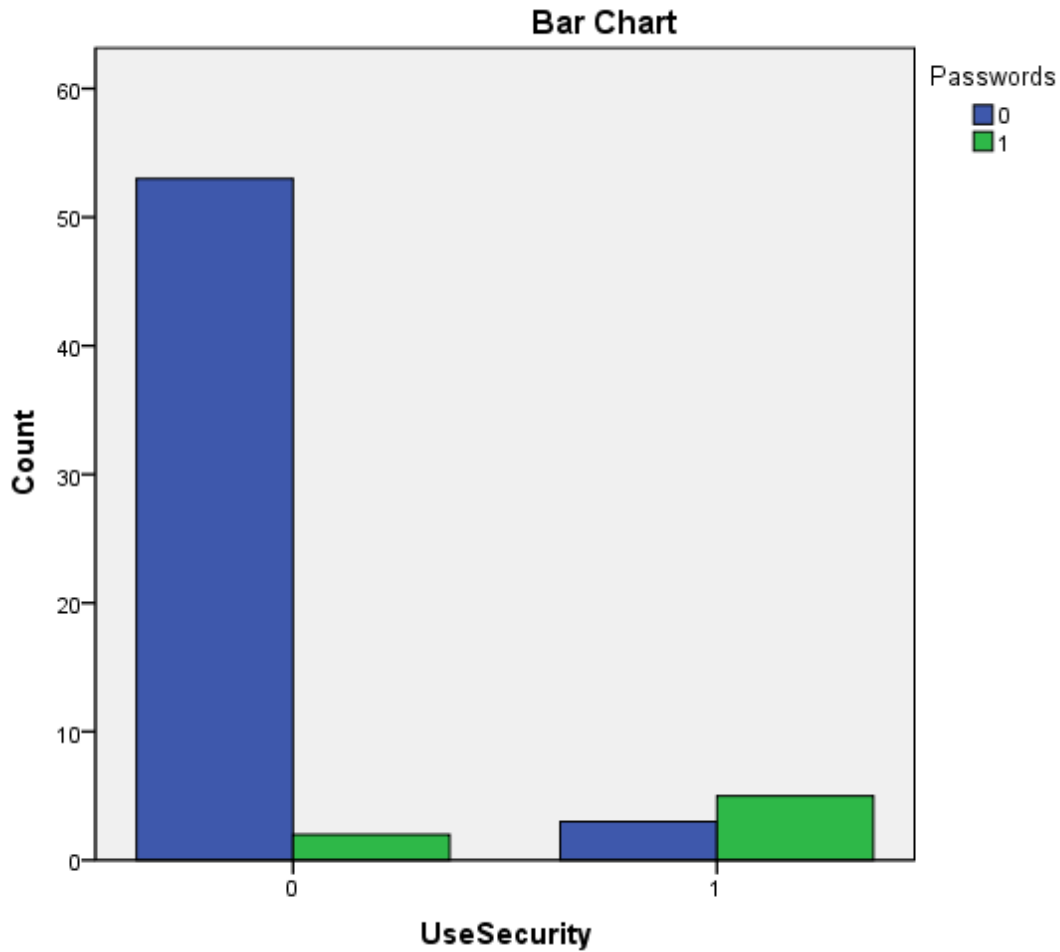
Figure 3. Use Flash and Attitude Toward Security



Use Security by Use Passwords

The relationship between using security and using passwords is displayed in Figure 4. The Phi coefficient was .624 and significant at the $p=.05$ level. Using security is strongly related to the use of passwords.

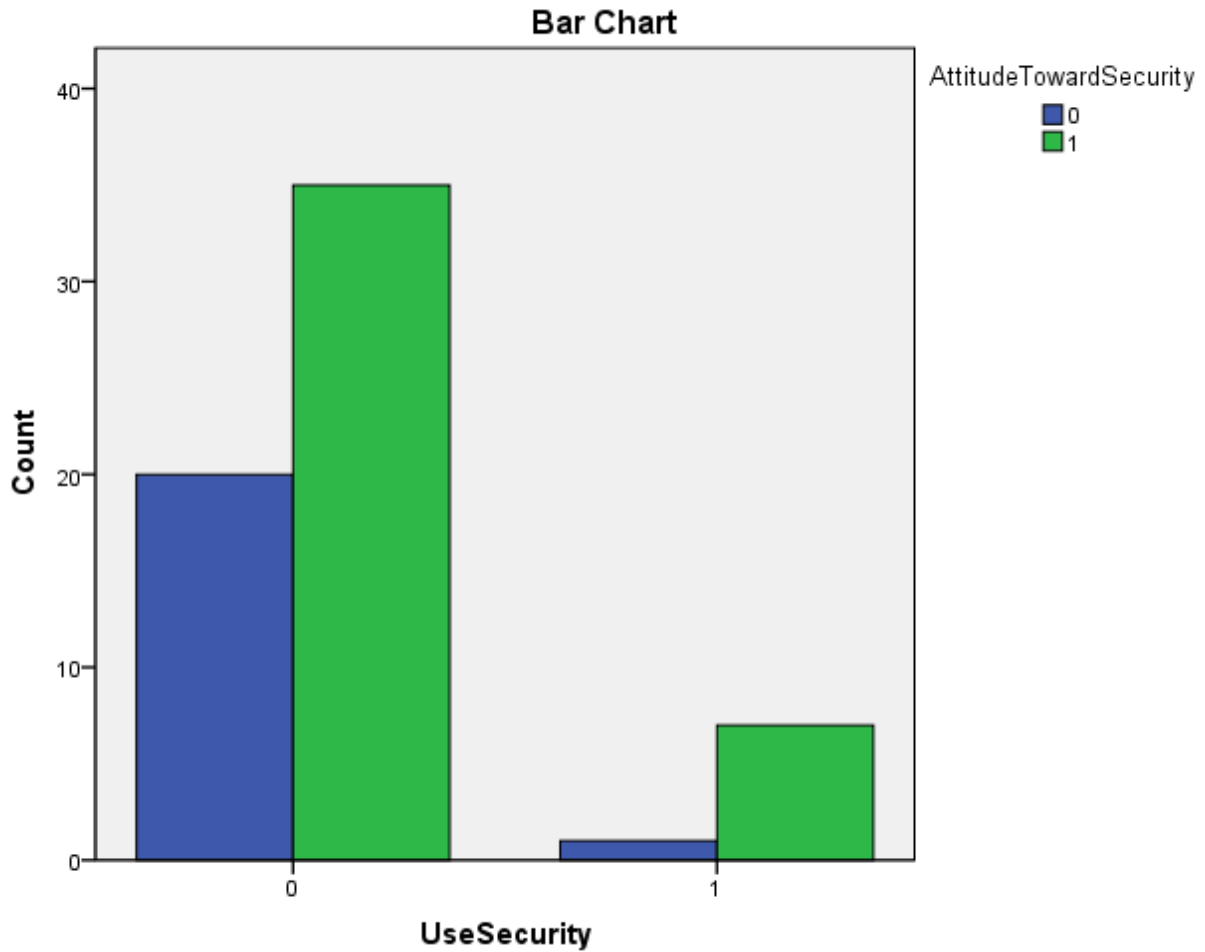
Figure 4. Use Security and Use Passwords



Use Security and Attitude Toward Security

The association between using security and attitude toward security is presented in Figure 5. The Phi coefficient was .169 and not significant at the $p=.05$ level. The use of security is only weakly related to attitude toward security.

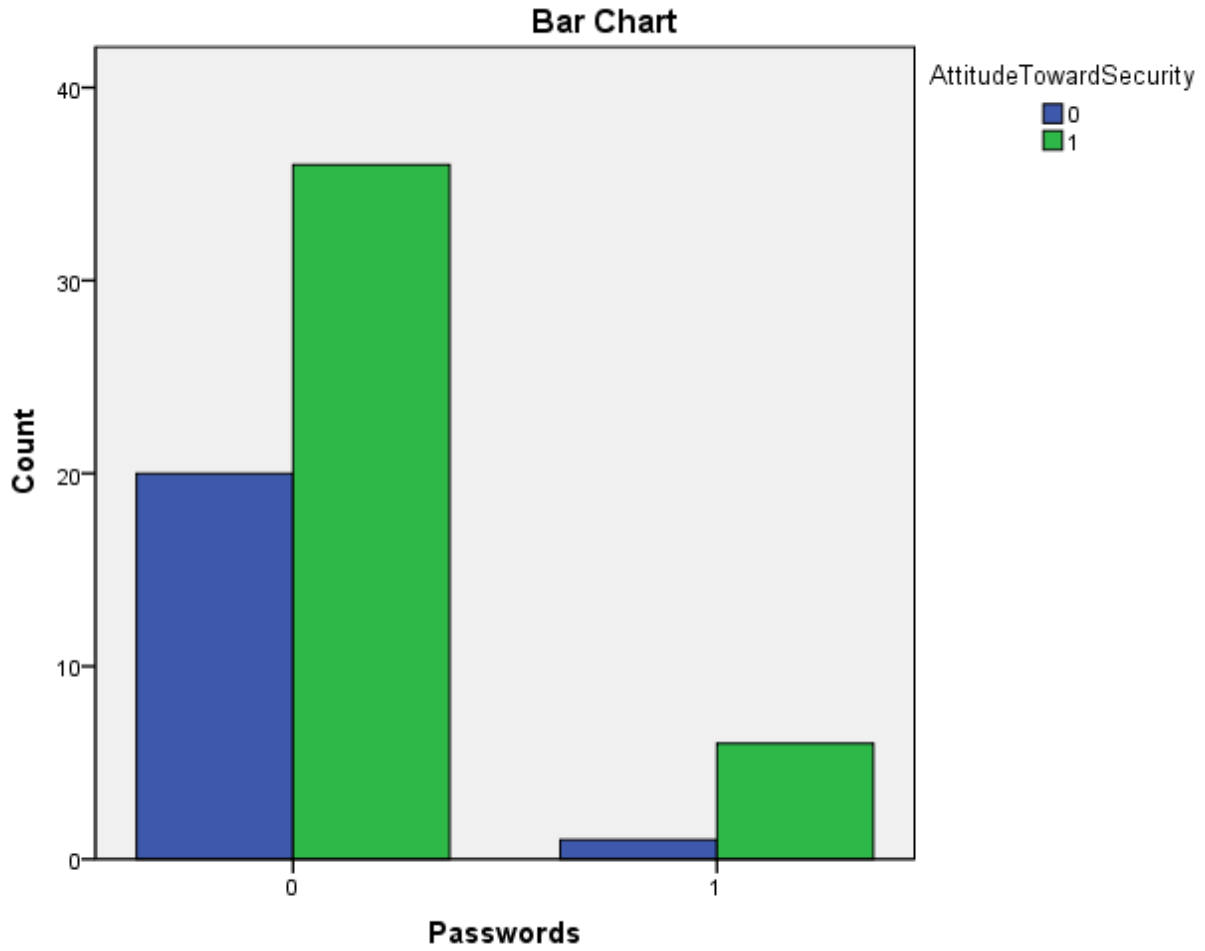
Figure 5. Use Security and Attitude Toward Security



Use Passwords and Attitude Toward Security

The association between using passwords and attitude toward security is provided in Figure 6. The Phi coefficient was .143 and not significant at the $p=.05$ level. Using passwords is weakly associated with attitude toward security.

Figure 6. Use Passwords and Attitude Toward Security



Summary of Phi Coefficients

The associations for all the variables are summarized in Table 2.

Table 2

Summary of Phi Coefficients

	Use Flash (UF)	Use Security (US)	Use Passwords (UP)	Attitudes Toward Security (ATS)
UF	X	.668*	.574*	.229
US	.624*	X	.624*	.169
UP	.574*	.624*	X	.143
ATS	.229	.169	.143	X

* = significance at the .05 level

Conclusion

This paper identified portable data storage devices as potential security victims to a variety of security issues. One solution advocated in the report is the TrueCrypt software that encrypts and hides data. The TrueCrypt software is particularly useful for safeguarding data on USB flash drives that are easily compromised. Whether or not individuals opt to secure their portable data devices is a function of their attitudes toward security and their subsequent behaviors. Data was collected from undergraduate students in business classes to examine some of the attitudes and practices toward USB Flash Drives. It was found that there were strong associations between the use of flash drives, security, and the use of passwords. All participants indicated that security for a flash drive was extremely important; all respondents also indicated that using security with a flash drive was important. More research is needed to connect attitudes and habits about safeguarding portable data storage devices such as USB Flash Drives and actual practices that are show evidence of steps taken toward securing the contents of these devices.

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Appendix A

Survey About Encryption and Portable Data Storage

1) Do you encrypt your USB flash drive?

Yes No

2) Do you use any type of security for your USB flash drive?

Yes No

3) How important do you think security is for a flash drive?

1 2 3 4 5

(1-extremely important, 2-somewhat important, 3-neutral, 4-not very important, 5-not important at all)

4) Do you use passwords to protect your USB flash drive?

Yes No

5) Do you backup your work?

Yes No

6) Do you think it is important to use security when using a USB flash drive?

Yes No

7) What year in school are you?

Freshman
Sophomore
Junior
Senior

APPENDIX B

Q1	Q2	Q3	Q4	Q5	Q6	Q7
0	0	1	0	1	1	3
0	0	1	0	1	1	4
0	0	1	0	1	1	4
0	0	1	0	1	1	2
0	0	1	0	1	0	4
0	0	1	0	1	0	4
0	0	1	0	1	1	4
0	0	1	0	1	1	3
0	0	1	0	1	1	4
1	0	1	0	1	1	3
0	0	1	0	1	1	4
0	1	1	1	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	0	2
0	0	1	0	1	0	4
0	0	1	0	1	0	3
0	0	1	0	1	0	4
0	0	1	0	1	0	3
0	0	1	0	1	1	1
0	0	1	0	1	1	4
0	0	1	0	1	0	4
0	0	1	0	1	1	4
1	1	1	1	1	1	2
1	1	1	1	1	1	2
1	1	1	0	1	1	1
0	0	1	0	1	0	2
0	0	1	1	1	1	4
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	0	2
1	1	1	1	1	1	2
0	0	1	0	1	1	2
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	0	3

0 0 1 0 1 1 3

APPENDIX B (Continued)

Q1	Q2	Q3	Q4	Q5	Q6	Q7
0	0	1	0	1	1	3
0	0	1	0	1	0	3
0	0	1	0	1	1	4
0	1	1	0	1	1	3
0	0	1	0	1	1	4
0	0	1	0	1	0	3
0	0	1	1	1	0	4
0	1	1	0	1	0	3
0	0	1	0	1	1	3
0	0	1	0	1	0	4
0	0	1	0	1	0	4
0	0	1	0	1	1	2
0	0	1	0	1	1	4
0	0	1	0	1	1	3
1	1	1	1	1	1	4
0	0	1	0	1	0	3
0	0	1	0	1	1	3
0	0	1	0	1	1	3
0	0	1	0	1	0	3
0	0	1	0	1	0	3
0	0	1	0	1	0	3

Privacy: An Analysis of the Literature

Ken Corley, Zack Jourdan, & Andrew Norton

Abstract

This research collects, synthesizes, and analyzes 67 articles on a variety of topics closely related to privacy published over a five-year period (2005-2009) in fifteen top Information Systems (IS) journals. We found a slight increase in the level of activity during 2006-2007 and a focus on exploratory research methodologies. We noted that several methodologies were either underrepresented or absent from the pool of privacy research. We also identified several subject areas that need further exploration from IS researchers.

Keywords: privacy, security, literature review, content analysis

Introduction

Daily reports of unauthorized information privacy disclosures are becoming quite common. Recent examples include Google's collection of unsecured data from private Wi-Fi networks; Facebook's continuous changes to privacy settings; and recent security breaches at AT&T which released over 100,000 email addresses of Apple iPad users (Montalbano 2010). In response to these incidents, the cost of managing the information privacy of organization stakeholders is increasing exponentially.

Forrester Research reported that despite the fact that total tech spending worldwide fell 9% in 2009, businesses increased security spending by 10% to \$33.8 billion (Tam and Worthen 2010). In June of 2010, the Wall Street Journal reported venture capitalists are investing heavily in start-up companies which are focused on protecting personal

information (Tam and Worthen 2010). These increases in investment highlight the worldwide concerns related to information privacy. This is of paramount importance given the ubiquitous nature of the Web and recent widespread dissemination of mobile computing devices.

Researchers in both academia and the corporate sector are continually striving to find effective methods of ensuring the privacy of stakeholder information. In order to advance such research, the methods used by researchers in a given field should be periodically evaluated (Scandura and Williams 2000). It is also important to identify any gaps in the literature so that researchers can work toward a more complete understanding of the field (Webster and Watson 2002).

The purpose of this paper is to examine the current literature to determine what is known about the concept of privacy within the domain of IS. The remainder of this paper is organized as follows: a description of the approach to the analysis of the privacy research is presented; followed by the results; and finally, the research is summarized with a discussion of the limitations of this project and suggestions for future research.

Research Study

We examined the number and distribution of privacy articles published in leading journals, the methodologies employed in the privacy research, and the research topics being addressed in privacy research. During our analysis, we identified gaps in the research which would allow us to propose and discuss a research agenda that will facilitate the progression of privacy research (Webster & Watson, 2002). We hope to paint a

representative landscape of the current privacy literature base in order to influence the direction of future research efforts in this important field.

In order to examine the current state of research on privacy, we conducted a literature review and analysis in three phases. First, we accumulated a representative pool of articles, then classified the articles by research strategy, and finally classified the articles by research topic. This methodology is borrowed from two similar studies conducted to analyze the literature for Enterprise Resource Planning (ERP) (Cumbie, Jourdan, Peachey, Dugo, & Craighead, 2005) and Business Intelligence (BI) (Jourdan, Rainer, & Marshall, 2008).

Accumulation of Article Pool

In order to explore the privacy research domain, we searched through a five year period (2005 – 2009) of the top 15 journals from IS. The top journals were identified by using four recent rankings of IS journals (Rainer & Miller 2005; Lowry, Romans & Curtis, 2004; Katerattanakul, Han & Hong, 2003; Peffers & Ya 2003). The rankings of the top journals produced a list totaling fifteen journals.

The Business Source Premier and Web of Science Databases were utilized to search for research articles by identifying titles and abstracts of each of the twenty journals using “privacy” as a search term. Book reviews and editorials were eliminated from the results.

Classification by Research Strategy

Once we identified the articles, we examined the research strategy used in each article and categorized it according to that strategy. Due to the subjective nature of method classification, we performed a content analysis of the articles. Figure 1 shows the process we followed, which was adapted from Neuendorf (2002). First, we defined the research method categories utilizing those presented in Scandura and Williams (2000), who extended the research strategies initially described by McGrath (1982). Specifically, we used nine categories of research strategies: Formal theory/literature reviews, sample survey, laboratory experiment, experimental simulation, field study - primary data, field study - secondary data, field experiment, judgment task, and computer simulation. To guard against the threats to reliability (Neuendorf, 2002), we performed a pilot on unused articles, discussed the results and refined the definitions.

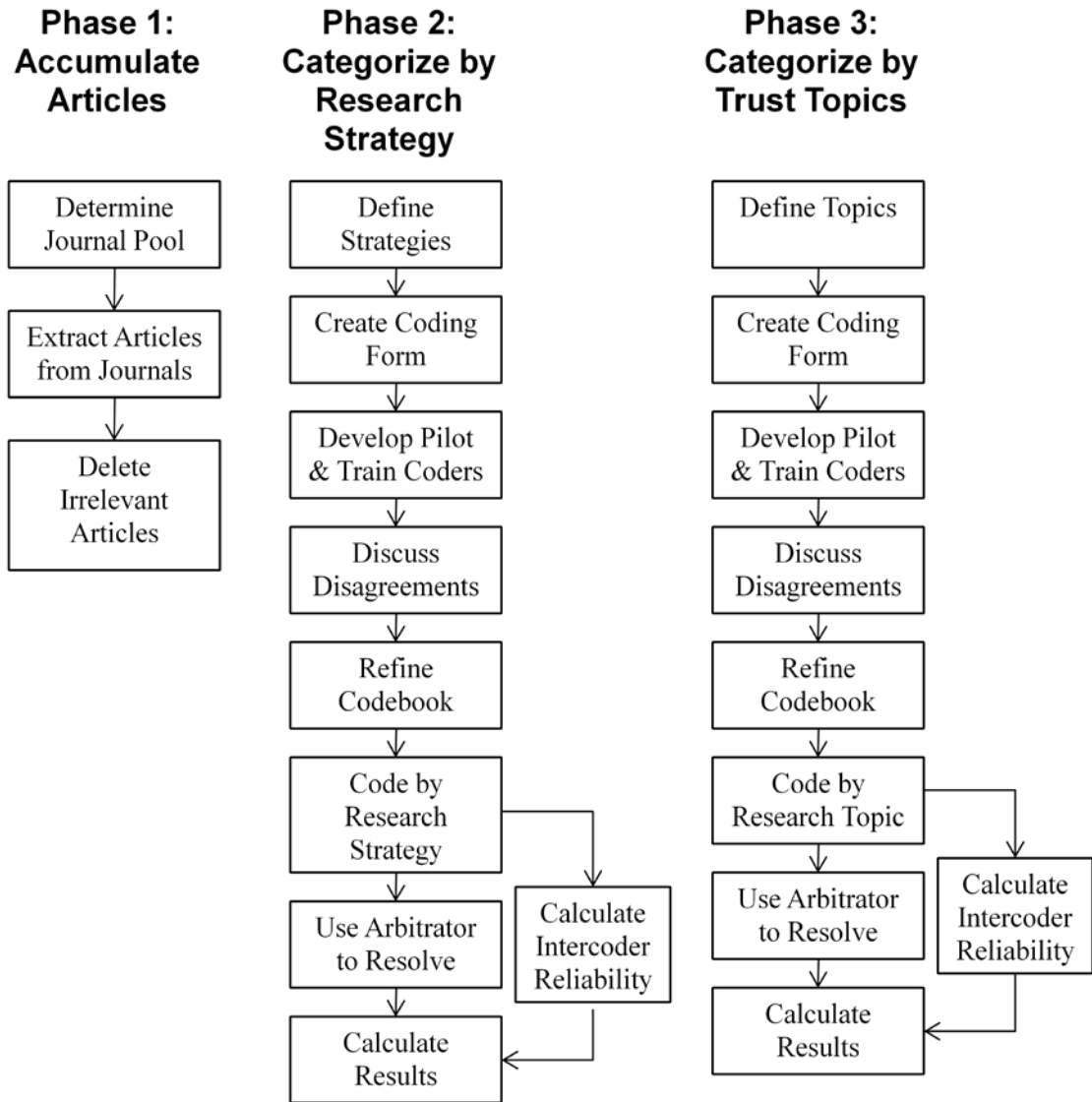


Figure 1. Overview of Literature Analysis

Each research strategy is defined by a specific design approach and each is also associated with certain tradeoffs that researchers must make when designing a study. These tradeoffs are inherent flaws that limit the conclusions that can be drawn from a particular research strategy. These tradeoffs refer to three aspects of a study that can vary depending on the research strategy employed. These variable aspects include: generalizability from the sample to the target population (external validity); precision in

measurement and control of behavioral variables (internal and construct validity); and the issue of realism of context (Scandura & Williams, 2000).

Cook and Campbell (1976) stated that a study has generalizability when the study has external validity across times, settings, and individuals. Formal theory/literature reviews and sample surveys have a high degree of generalizability by establishing the relationship between two constructs and illustrating that this relationship has external validity. A research strategy that has low external validity but high internal validity is the laboratory experiment. In the laboratory experiment, where the degree of precision of measurement is high, cause and effect relationships may be determined, but these relationships may not be generalizable for other times, settings, and populations. While the formal theory/literature reviews and sample surveys have a high degree of generalizability and the laboratory experiment has a high degree of precision of measurement, these strategies have low degree of realism in context. The only two strategies that maximize degree of realism of context are field studies using either primary or secondary data because the data is collected in an organizational setting (Scandura & Williams, 2000). The other four strategies maximize neither generalizability, nor degree of precision in measurement, nor degree of realism in context. This point illustrates the futility of using only one strategy when conducting privacy research. Because no single strategy can maximize all types of validity, it is best for researchers to use a variety of research strategies. Table 1 contains an overview of the nine strategies and their ranking on the three strategy tradeoffs (Scandura & Williams, 2000).

Table 1. Research Strategies*

Research Strategy	Description	Strategy Tradeoffs		
		<i>Degree of Precision Measurement</i>	<i>Degree of Realism of Context</i>	<i>Generalizability to Target Population</i>
Formal Theory/Literature Reviews	Summarization of the literature in an area of research in order to conceptualize models for empirical testing.	Low	Low	Maximizes
Sample Survey	The investigator tries to neutralize context by asking for behaviors that are unrelated to the context in which they are elicited.	Low	Low	Maximizes
Laboratory Experiment	Participants are brought into an artificial setting, usually one that will not significantly impact the results.	Maximizes	Low	Low
Experimental Simulation	A situation contrived by a researcher in which there is an attempt to retain some realism of context through use of simulated situations or scenarios.	Moderate	Moderate	Low
Field Study: Primary data	Investigates behavior in its natural setting. Involves collection of data by researchers.	Low	Maximizes	Low
Field Study: Secondary data	Involves studies that use secondary data (data collected by a person, agency, or organization other than the researchers).	Low	Maximizes	Low
Field Experiment	Collecting data in a field setting but manipulating behavior variables.	Moderately High	Moderately High	Low
Judgment Task	Participants judge or rate behaviors. Sampling is systematic vs. representative, and the setting is contrived.	Moderately High	Low	Moderately High
Computer Simulation	Involves artificial data creation or simulation of a process.	Low	Moderately High	Moderately High

* Source (Scandura & Williams, 2000)

Two coders independently reviewed and classified according to research strategy. Only a few articles were reviewed at one sitting to minimize coder fatigue and thus protect inter-coder reliability (Neuendorf 2002). Upon completion of the independent classification, a tabulation of agreements and disagreements were computed, inter-coder crude agreement (percent of agreement) was determined, and inter-coder reliability using Cohen’s Kappa (Cohen 1960) was calculated. The latter two calculations were well within the acceptable ranges for inter-coder crude agreement and inter-coder reliability

(Neuendorf 2002). The reliability measures were calculated prior to discussing disagreements as mandated by Weber (1990). If initial reviewers did not agree on how a particular article was coded, an additional reviewer arbitrated the discussion of how the disputed article was to be coded. This process resolved the disputes in all cases.

Classification by Privacy Research Topic

To classify articles by research topic, we held several brainstorming and discussion sessions where we attempted to identify privacy topics with the intent to categorize the diverse body of literature. In these discussion sessions, we sought to synthesize the literature and provide a better understanding of the current state of privacy research. Once we established the category definitions, we independently placed each article in one privacy category. As before, we placed only a few articles at a time to minimize coder fatigue and thus protect inter-coder reliability (Neuendorf 2002). Upon completion of the classification process, we tabulated agreements and disagreements, inter-coder crude agreement (percent of agreement), and inter-coder reliability using Cohen's Kappa (Cohen 1960) for each category. Again, the latter two calculations were well within the acceptable ranges (Neuendorf 2002). We again calculated the reliability measures prior to discussing disagreements as mandated by Weber (1999). If two reviewers did not agree on how a particular article was coded, a third reviewer arbitrated the discussion of how the disputed article was to be coded. This process also resolved the disputes in all cases.

Results

Using the described search criteria within the selected journals, we collected a total of 67 articles (see Table 2). (For the complete list of articles in the sample, please see Appendix A.)

Table 2. Number of Articles per Journal

Rank	Information Systems Journals	#
1	MIS Quarterly	6
2	Information Systems Research	4
3	Communications of the ACM	12
4	Journal of Management Information Systems	5
5	Management Science	6
6	Journal of the ACM	2
7	European Journal of Information Systems	5
8	IEEE Transactions on Software Engineering	4
9	Information & Management	6
10	Harvard Business Review	0
11	Decision Sciences	2
12	Artificial Intelligence	3
13	Communications of the AIS	0
14	Decision Support Systems	9
15	Human Computer Interaction	3
		67

In addition, Table 3 shows a steady stream of privacy research in each year of the literature sampled. A particularly large number of research articles in any given year could be caused by an abundance of special issues published on the topic. On the other hand, a declining trend would show that the topic was very popular for a brief time, but interest in the topic has subsided. These numbers indicate a fairly steady production of privacy research.

Table 3. Number of Privacy Articles per Year

Year	Privacy Articles	%
2005	11	16.4%
2006	18	26.9%
2007	14	20.9%
2008	11	16.4%
2009	13	19.4%
Total	67	100.0%
%	100.0%	

Productivity of authors who published in this line of research was analyzed by assigning scores based upon an author's share of the article. Because most articles in our sample were projects with multiple authors, we decided that each co-author would be given an equal share of the credit. For example, an author who published an article alone was assigned a score of 1.0; two authors earned a score of .500 each; a three author article earned each author a score of .333; and so on. The scores for each author were totaled, the authors were sorted from highest to lowest scores, and the results of the top twenty-two authors (22 authors were chosen because there was a 3-way tie for #20) are displayed in Table 4. Authorship order was not calculated into this formula. This system rewards both quantity of research and ownership of research.

Table 4. The Top 22 Authors in Privacy Research

Rank	Author	#	Score
1	Kim, D J	4	2.167
2	Muralidhar, K	3	1.500
3	Sarathy, R	3	1.500
4	Sarkar, S	3	1.333
5	Piramuthu, S	2	1.333
6	Awad, N F	2	1.000
7	Culnan, M J	2	1.000

8	Kobsa, A	1	1.000
9	Moores, T T	1	1.000
10	Pollach, I	1	1.000
11	Rose, E A	1	1.000
12	Shilton, K	1	1.000
13	Hui, K L	3	0.833
14	Lee, S Y T	3	0.833
15	Li, X B	2	0.833
16	Menon, S	2	0.833
17	Rao, H R	2	0.833
18	Spiekermann, S	2	0.833
19	Anton, A I	2	0.750
20	Dinev, T	2	0.667
21	Hart, P	2	0.667
22	Suzuki, K	2	0.667

Analysis of Research Strategies in Privacy Research

The categorization of the 67 articles according to the nine research strategies produced the following results (Table 5). 22 articles (32.8%) were classified as Formal Theory/Literature Review and 21 articles (31.3%) were classified as Field Study-Primary, making these the two most prevalent research strategies. Other categories, in decreasing order, are Field Study-Secondary Data (14.9%), Computer Simulation (10.4%), Sample Survey (6.0%), and Field Experiment (3.0%). Judgment Task yielded only one article, and no articles were classified as Lab Experiment or Experimental Simulation.

Analysis of the research strategies over the five year period from 2005 to 2009 illustrates that Formal Theory/Literature Review, Field Study-Primary Data, Field Study-Secondary Data, and Computer Simulation are represented in almost every year of the time frame. These four strategies are exploratory in nature and indicate the beginnings of a body of research (Scandura & Williams 2000).

Table 5. Research Strategy vs. Year

	2005	2006	2007	2008	2009	Total
Formal Theory/Lit. Review	4	6	4	3	5	22
Sample Survey		1		2	1	4
Lab Experiment						0
Experimental Simulation						0
Field Study - Primary	3	6	5	4	3	21
Field Study - Secondary	2	3	2		3	10
Field Experiment	1		1			2
Judgment Task			1			1
Computer Simulation	1	2	1	2	1	7
	11	18	14	11	13	67

Analysis of Privacy Research Topics

The articles were analyzed and four relatively distinct research topics emerged (Table 6). The ‘Implementation’ topic consists of 21 articles that explored the role of privacy in (a) data sharing / data mining, (b) personalization, (c) programming, and (d) encryption. ‘Regulation and Policy’ represents 20 articles which focus on the role of privacy as it relates to: (a) public / government policy; (b) corporate policy; (c) web site privacy seals; and (d) regulation of health care and employee monitoring. The topic of ‘Risk’ includes 11 articles which focus on identifying and managing threats to information privacy at both the individual and organizational level. The final topic of ‘Theory’ is a potential indicator of the current state of research in the area of privacy. ‘Theory’ represents 15 articles dedicated to analyzing practitioner and academic literature in an effort to develop solid theories related to information privacy.

Table 6. Privacy Topics

<i>Trust Research Topics</i>	<i>Acronym</i>	<i>Key Concepts</i>	<i>Privacy Articles</i>
Implementation	I	Data sharing/mining; Programming; Personalization; Encryption	21
Regulation & Policy	R&P	Public and Corporate Policy; Web Site Privacy Seals; Employee Monitoring; Healthcare Regulation	20
Risks	R	Identification and management of threats to information privacy – both at the individual and organization level	11
Theory	T	Analysis of practitioner and academic research literature to develop theory related to information privacy	15
Total			67

Privacy Research Topics vs. Research Strategy

An examination of privacy topic versus research strategy (Table 7) identifies the research strategies used in articles on the various privacy topics. Understanding that the Formal Theory/Literature Review and Field Study-Primary Data are the most popular research strategies used to investigate the research topics, it is possible that the body of privacy research is moving from the exploratory to the confirmatory stage. Higher numbers of field studies may be a sign that the theories surrounding privacy within the information systems discipline may be in the process of transitioning out of the exploratory theory development stages characterized by formal theory development and literature

review research. The use of field studies, computer simulation, and sample surveys indicate that these theories are being tested (Scandura & Williams 2000). The way to explore the progress of a body of knowledge is to see whether new theories are still being developed or theories are being tested for the research stream (Webster & Watson 2002).

Table 7. Privacy Topic vs. Research Strategy

	I	R&P	R	T	Total	%
Formal Theory/Lit. Review	12	4	4	2	22	32.8%
Sample Survey		1		3	4	6.0%
Lab Experiment					0	0.0%
Experimental Simulation					0	0.0%
Field Study – Primary	2	6	5	8	21	31.3%
Field Study - Secondary	3	6	1		10	14.9%
Field Experiment		2			2	3.0%
Judgment Task		1			1	1.5%
Computer Simulation	4		1	2	7	10.4%
Total	21	20	11	15	67	100.0%
Percentage	31.3%	29.9%	16.4%	22.4%	100.0%	

It is possible that the privacy research stream is more mature than this literature review indicates. An inherent problem with business research is that some of these research strategies are very difficult to execute. A more extensive literature review is necessary to see if this research stream has matured over the last decade.

Limitations and Directions for Future Research

Our analysis of the privacy literature is not without limitations. Future literature reviews could search a broader range of time and/or larger domain of research outlets. Further, future privacy studies should consider the research gaps that we have identified in light of generalizability, precision of measure, and realism of context. Future efforts should also explore the gaps identified in the four privacy research topics with respect to the

research strategies. For researchers to continue to address important questions about privacy, future studies need to employ a wider variety of research strategies.

Scandura and Williams (2000) stated that looking at research strategies employed over time by triangulation in a given subject area can provide useful insights into how theories are developing. In addition to the lack of variety in research strategy, very little triangulation has occurred during the timeframe used to conduct this literature review. This absence of coordinated theory development causes the research in privacy to appear haphazard and unfocused. However, the good news is that many of the categories and research strategies in this body of privacy research are open for future research efforts.

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APPENDIX A

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Analyzing Theories in the Studies on Online Information Privacy Concerns: Comparison and Integration

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Abstract

While multiple theories have been adopted in the studies on online information privacy concerns, there are overlapping and interconnections between the theories that need to be addressed. Based on the analysis of extant theories in literature, this research develops an integrative framework to provide further guidance for research. It highlights achievements made in this area and the limitations that needed to be conquered. Future research directions are discussed.

Keywords: information privacy concerns, privacy calculus, protection motivation theory

Introduction

Individuals' concerns for information privacy (CFIP) play important roles in determining their online behaviors in today's ubiquitous e-commerce environment. Evidence shows that people with high levels of concerns for online information privacy would take protective activities to prevent or minimize the privacy risks (Son and Kim, 2008). This kind of self-protective behavior has important meanings for individuals as well as businesses who want to provide personalized services to customers (Awad and Krishnan, 2006).

Academic research has adopted various theoretical frameworks to analyze the

antecedents and consequences of CFIP, such as the procedural fairness theory (Culnan and Armstrong, 1999), theory of reasoned action (Dinev and Hart, 2006), expectancy theory (Hann et al., 2007), social contract theory (Malhotra et al., 2004), and protection motivation theory (Zhang and McDowell, 2009). To date, there has not been a single study to compare the theories applied in this area, which has caused a number of limitations in literature. First, while different theories approach the privacy issues from various perspectives, there are possible overlapping and connections between theories that need to be recognized. Recognizing the connections between theories is helpful in fortifying the theoretical basis of the field, which is critical for studies that draw upon several theoretical frameworks. Secondly, certain aspects of the theories that have not been fully utilized in research should be recognized. By exploring the under-investigated areas in the theories, it is possible to conduct research for interesting outcomes.

This study analyzes theories in CFIP research in order to build an integrative framework for further studies. It first recognizes and reviews theories in the field, with a focus on the analysis of the distinctions as well as relationships between the theories. The integrative framework is then presented and key constructs and relationships in the framework are discussed. Finally, future research directions are briefly outlined.

Theories in CFIP Research: A Review

Ever since Smith et al. (1996) developed the measurement scale for CFIP, information privacy has become an important area of research in the business field (Chan et al., 2005). Multiple theories have been applied to interpret individuals' concerns for online information privacy and predict their impact on human behaviors. Via an extensive search for literature in both online and offline sources, the following theories are recognized and summarized.

- *Theory of reasoned action and theory of planned behavior*

Both theory of reasoned action (TRA; Ajzen and Fishbein, 1980) and its later revision, the theory of planned behavior (TPB; Ajzen, 1991), depict that a person's volitional behavior is directly driven by behavioral intention, which in turn is determined by a number of antecedents including personal beliefs, attitude, and subjective norm. Distinction exists where TPB further added perceived behavioral control as an additional driver of behavior intention and behavior.

Most of the studies recognized in the literature research cited either or both theories, although the emphasis was put on the belief-intention-behavior link while other antecedents were less frequently analyzed.

A common hypothesis in the studies is that personal belief of information privacy, i.e., CFIP, would negatively influence the behavioral intention to give personal information for e-commerce transactions. Empirical studies have provided almost unanimous support of this hypothesis. Nevertheless, since other personal beliefs co-exist with CFIP, and some may favor the behavior of giving information for expected benefits (Awad and Krishnan, 2006; Hann et al., 2007), it raises the question of how individuals evaluate and summarize the multiple benefit and risk beliefs. To address this issue, the famous “privacy calculus” was applied.

- *Privacy calculus theory*

Strictly speaking, privacy calculus is not a single theory but a cluster of theories that are used to compare and aggregate the contradicting expectations and beliefs regarding information provision and protection (Dinev and Hart, 2004, 2006). The central tenet is that given the cost (i.e., privacy risks) and benefit expectations of the information behavior, a person would evaluate the tradeoffs between cost and benefit and then decide what to do. Due to the distinctions in the specific cost and benefit factors analyzed and the specific procedures to assess those factors, a number of theories were applied to implement the calculus, including utility maximization theory and expectancy theory, summarized as follows.

- *Utility maximization theory*

Utility maximization theory is the adoption of economic exchange theories in the social exchange domain; in terms of information provision and privacy, the theory depicts the utility function as the difference between benefits (such as personalized service) and costs (including consumer privacy concerns and risks; Awad and Krishnan, 2006; Hann et al., 2007). If the overall cost exceeds the expected benefit, a person would not provide information to an online vendor. Several studies have implicitly applied the utility function with various combinations of cost and benefit factors. For example, Dinev and Hart (2006) studied the impact of personal Internet interest and information privacy concerns on the willingness to provide information; Xu et al. (2009) studied the influence of benefit and risk beliefs on intention to disclose information

for location-based services. These studies confirmed the roles of the privacy utility function in behavior formation.

- *Expectancy theory of motivation*

This theory suggests that behavioral motivation is the function of three distinct perceptions (expectancy, instrumentality, and valence) of the relationship between three distinct events (effort, performance, and outcomes; Vroom, 1964). Using Hann et al.'s (2007) example of registering at a financial web site to trade stocks, the effort of registering by providing the requested personal and portfolio information to the web site results in signing up with the financial web site, which is the instrument that provides the individual more convenience in checking the stock portfolio and becoming updated on financial news. These positive outcomes are accompanied by negative ones such as privacy loss. The result is that the individual, when deciding whether to provide private information and register on the web site, would value both the positive and negative outcomes, and then choose the corresponding behavior.

From the web site's point of view, providing mechanisms to enhance benefits and reduce privacy concerns would improve individuals' expected values and motivate them to contribute information. In addition to the provision of benefits, the web site may apply other approaches to reduce the privacy concerns of individuals; a number of theories illustrate how, as reviewed below.

- *Procedural fairness theory*

An approach for organizations to reduce customers' privacy concerns is to provide procedural fairness (Culnan and Armstrong, 1999). This theory shows that even if outcomes are not favorable to a person, the person is less likely to become dissatisfied with unfavorable outcomes if he or she believes that the procedures used to derive those outcomes are fair. An organization may promote the customer disclosure of personal information by disclosing its information policies (such as privacy statements) to the customer, assuming that its subsequent practices are consistent with the policies.

- *Social presence theory*

Another approach to reduce privacy concerns is to increase the social presence of a web

site. The social presence theory suggests that the extent to which a consumer feels that the online environment closely resembles a physical interaction with a seller would create a notion of human touch and treat the web site as a social actor (Zimmer et al, 2010), which helps to mitigate privacy concerns (Pavlou et al., 2007). Web sites may use multiple approaches to achieve the goal, such as using rich media (e.g., videos) to announce privacy policies rather than using the text version of the privacy statements (Aljukhadar et al., 2010).

- *Social contract theory*

The provision of information is not only economic exchanges but also social exchanges, for which social contracts are critical to prevent the organizations' opportunistic behavior to misuse customers' information (Hoffman et al., 1999). The social contract theory in the context of online information privacy means that individuals are willing to disclose personal information as long as they perceive that the organization would uphold its side of the social contract (Dhillon and Moores, 2001). The theory also suggests that a firm's collection of personally identifiable data is perceived to be fair only when the consumer is granted control over the information and informed about the firm's intended use of that information (Malhotra et al., 2004). Both procedure fairness and vendor intervention are important antecedents of social contract (Faja and Trimi, 2006).

- *Social response theory*

Social response theory, also known as self-disclosure theory, suggests that people will engage in self-disclosing behavior if they are the recipient of a similar disclosure from their partner first (Collin and Miller, 1994). Zimmer et al. (2010) use the theory to study how a web site may establish a reciprocal relationship with customers in order to enhance voluntary information disclosure. They suggest that to reap the benefit of the reciprocal relationship, a web site should start the interaction with customers with exchanges of less intimate (or less sensitive) information and build up to the exchange of more intimate information. They further argue that by improving social presence and social contract (trust), a web site can encourage social responses from the customers, i.e., giving more information about themselves.

- *Protection motivation theory*

In addition to the above institutional approaches to ease privacy concerns, individuals

may rely on self-protective behavior to discern and reduce privacy risks. Protection motivation theory provides a conceptual framework to understand individuals' fear appeal and behavioral change (Chai et al., 2009; Junglas et al., 2008; Zhang and McDowell, 2009). It suggests that an individual's intention to protect him or herself from potential threats depends on four factors: the perceived severity of a threatening event, the perceived probability of the occurrence, the efficacy of the recommended preventive behavior that an individual expects to carry out, and the individual's perceived ability to undertake the recommended preventive behavior (Rogers, 1975). Factors recognized in this perspective include: information privacy exposure, information privacy importance, information privacy anxiety, and information privacy self-efficacy (Chai et al., 2009); perceived severity, perceived vulnerability, fear, response efficacy, and response cost (Zhang and McDowell, 2009); and personality traits (Junglas et al., 2008). The empirical results generally support the theory.

- *Information boundary/intrusion theory*

When two organizations or any other entities access the same information about an individual, the perceived threat may differ (Rohm and Milne, 2004). To judge whether an information access is a threat, the information boundary theory is utilized. The theory posits that each individual forms a physical or virtual informational space around him or her with clearly defined boundaries, and depending on the situational and personal conditions, an attempt by an external entity to penetrate these boundaries may be perceived as threat or intrusion (Xu et al., 2008). Institutional factors such as privacy policies and vendor-customer relationships have potential impacts on information boundary, and so does personality traits such as disposition to value privacy (Xu et al., 2008). In addition, the provision of benefits may also "erode" the information boundary and delay the intrusion alert.

- *Social cognitive theory*

Both the protection motivation theory and the information boundary/intrusion theory emphasize the roles of an individual's perceived capability to cope with privacy intrusion, which is interpreted in the social cognitive theory (Bandura, 1986). This theory premises that personal factors in the form of cognitive, affective, and biological events, as well as behavioral and environmental events, all operate as interacting determinants that influence each other. A well-

known cognitive factor based on this theory is self-efficacy (Chai et al., 2009); a similar construct, perceived ability to control, also has an impact on CFIP (Dinev and Hart, 2004).

- *Personality theories*

These theories suggest that personality traits, referring to individual's stable psychological attributes, would have potential impact on privacy concerns and behavior. These include cynical distrust, paranoia, and social criticism (Smith et al., 1996); social awareness (Dinev and Hart, 2005); and the Big Five personality traits including extraversion, agreeableness, conscientiousness, neuroticism, and intellect (Korzaan and Boswell, 2008). While some personality traits have a significant impact on privacy concerns, not all exert that impact. Compared to other factors, personality traits function as antecedents to all other personal beliefs.

In sum, a variety of theoretical lenses are available to interpret CFIP, from which important factors and processes associated with the formation of CFIP and its consequences are recognized. In the next section, a brief analysis of the theories is presented, based on which an integrative framework is developed.

Development of an Integrative Theoretical Framework

The above review shows that although the theories applied in CFIP research present somewhat different solutions to privacy issues, they possess a lot of commonalities and connections. Several key conclusions may be drawn from the review:

1. Both TRA and TPB, especially the belief-intention-behavior link, provide a common basis for CFIP research, predicting the negative impact of a person's CFIP belief on the behavioral intention to provide information. Perceived behavioral control in TPB is further analyzed in social cognitive theory via the self-efficacy construct. However, neither TRA nor TPB provides details about the positive and negative expectations a person has about a web site, which is interpreted in other theories.
2. Privacy calculus theory, including utility maximization theory and expectancy theory, provides a means to interpret how a person compares perceived benefits against perceived risks before providing personal information. The forms of benefits vary

substantially, but the risk perception is primarily about privacy risks or CFIP.

3. In terms of privacy concern, the protection motivation theory helps to assess its existence (i.e., threat appraisal) and the efficacy of the coping mechanisms (e.g., information privacy self-efficacy; Chai et al., 2009). A person's privacy concern can be mitigated if the privacy intrusion is unlikely, or the coping mechanism is successful, or both.
4. Organizations such as e-commerce web sites may mitigate perceived likelihood of privacy intrusion via procedure fairness, social presence, social contract, and social response. The corresponding theories interpret how. These institutional mechanisms are internally connected: for example, procedure fairness helps to establish social contract (Faja and Trimi, 2006), and both social presence and social contract (trust) encourage social response or self-disclosure of private information (Zimmer et al., 2010).

Being aware of the links among theories is helpful in strengthening the theoretical basis in this field and illuminating future research directions. Based on the analysis, an integrative theoretical framework is proposed and illustrated in Figure 1. The constructs and the relationships in the framework are explained as follows.

First of all, the framework uses TRA and TPB as the theoretical foundation due to their impact on CFIP research. As mentioned above, TPB poses that individual behavior is directly driven by behavioral intention, which in turn is determined by attitude, subjective norm, and perceived behavioral control (such as self-efficacy belief; Ajzen, 2002). Attitude, according to TRA, is influenced by a number of behavioral beliefs and outcome evaluations. Many of the studies adopting TRA/TPB have focused on the understanding of the formation and changes in privacy belief as well as other personal beliefs such as perceived benefits. How those studies fit in the TRA/TPB framework is analyzed next.

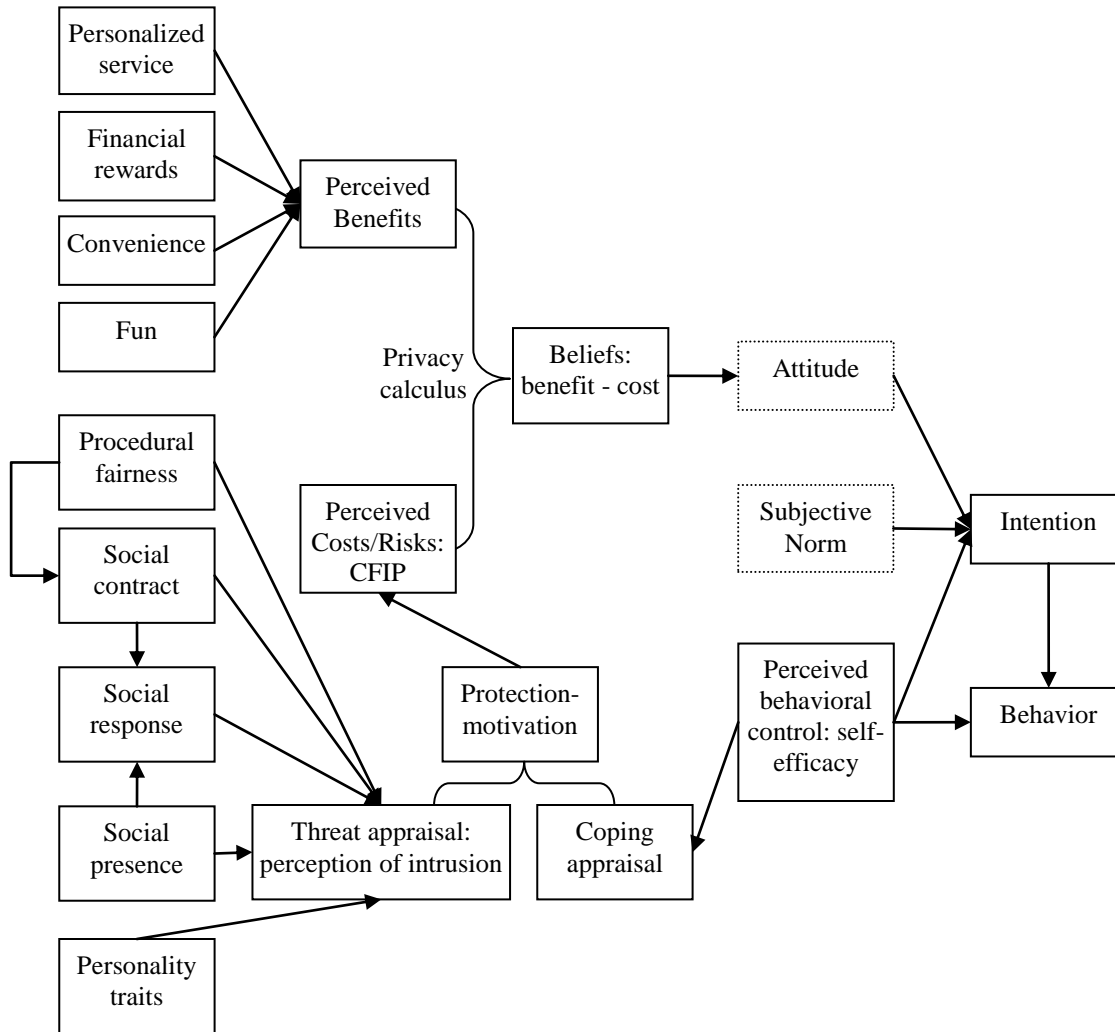


Figure 1. An integrative framework of theories in CFIP research.

First, privacy calculus, either from the utility maximization perspective or from the expectancy-motivation perspective, functions as a summation of personal beliefs regarding the positive and negative aspects of information behavior. No significant difference was found between utility maximization theory and expectancy theory in the ways they were operationalized in CFIP research; rather, the two theories perform privacy calculus in compatible ways, as exemplified in Hann et al.'s (2007) study and discussed by Dinev and Hart (2006). Of the various components of a privacy calculus, convenience, personalized service, fun, and financial rewards all contribute to the benefit beliefs (Awad and Krishnan, 2006; Hann et al., 2007). Although other cost and uncertainty components such as security concerns and fear of

seller opportunism exist (Pavlou et al., 2007), the focus of the privacy calculus is on CFIP. Major efforts in CFIP research were to understand its influential factors.

Factors that influence CFIP belief include both institutional forces (including procedural fairness, social contract, social response, and social presence) and individual forces (e.g., protection motivation, information boundary, self-efficacy, and personalities). Although some studies treated the institutional forces as direct antecedents of CFIP, the review shows that the specific mechanisms are made through their influences on threat assessments by web users based on their perceptions of the probability and severity of the privacy threats. Specifically, the various institutional forces are targeted at reducing the assessed threat by individuals. Meanwhile, individuals may use coping mechanisms, such as self-efficacy (Chai et al., 2009; Zhang and McDowell, 2009) and perceived ability to control (Dinev and Hart, 2004), to counterbalance the threat, as both self-efficacy and perceived ability to control were found to reduce CFIP. Consistent with protection motivation theory and the findings from the literature review, protection-motivation mediates the impact of the institutional and individual forces on CFIP, as shown in Figure 1.

In addition, both self-efficacy and perceived ability to control are examples of perceived behavioral control in TPB (Ajzen, 2002), suggesting a direct impact of perceived behavioral control on protection motivation. The above review also suggests potential relationships between the institutional forces, such as the impact of procedural fairness on social contract (Culnan and Armstrong, 1999). These additional relationships are illustrated in Figure 1.

Finally, while information boundary is an important concept in forming privacy concerns, such boundary best serves as the criterion to evaluate privacy intrusion, and the perception of intrusion, according to the theory, is determined by privacy risk assessment and perceived privacy control (Xu et al., 2008). Therefore, information boundary theory is merged into the protection motivation theory.

Discussion and Concluding Remarks

Both Figure 1 and the above analysis show that extant literature emphasizes the mechanisms to mitigate privacy concerns. Although this trend has important theoretical and

practical meanings, other factors in the framework should not be overlooked. Several areas need to be stressed. First, attitude and subjective norms have not received sufficient attention in CFIP research, except for a few studies that address social norms (e.g., Xu et al., 2008). While reasons for excluding these factors in research have been discussed, it would be necessary to include these factors in a more comprehensive research setting, especially in studies on the use of social networking sites. For example, a person who wants to make friends on Facebook.com should first of all release personal information such as interests and hobbies, which is expected by other existing users.

Second, the two mechanisms under protection motivation theory have not been fully analyzed, especially the coping mechanisms. In countries without omnibus protection on personal information, individuals' self-protective behavior has important meanings for their privacy, as compared to organizations' and industries' self-regulation. Helping people to develop adequate coping mechanisms to deal with privacy concerns would have significant impact on the Internet community. With regard to this, self-efficacy and prior experience of individuals would provide some preliminary clues (Culnan and Armstrong, 1999), although knowledge in this area should be deepened.

Third, further research is needed to recognize or design additional benefits for those who provide personal information. Although privacy concerns are critical and sometimes sensitive, studies show that under certain circumstances people would easily forget privacy concerns in exchange of benefits (Berendt et al., 2005). This suggests that more theories are needed to clearly identify online customers' demands and enable effective design of benefit schemes for those who want to share information. Of course, organizations should be aware that customers' private information should be protected and properly used to maximize customer values rather than satisfying the organizations' own demands.

The research has a number of contributions to the studies on CFIP. First, it provides a summary of popular theories in the area, rendering researchers a reference to pinpoint needed theories for further research. Second, it compared the theories systematically, highlighting the commonalities as well as unique features in each theory. This enables scholars to conduct more focused research with needed theoretical stances. Third, it recognizes the fit between the theories and their relationships. The integrative framework in Figure 1 provides a preliminary solution for

combining the multiple theoretical frameworks. Finally, several future research directions are developed from the framework. The next step is to develop a research model from the framework and test with empirical data, and compare the explanation power of the model against other existing theories or studies.

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Accounting's Role in New Product Development (NPD)

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Abstract

What percentage of a company's revenues came from new products last year? What will be the percentage next year, or ten years from now? Many companies are finding the need for new products requires a continuing effort in new product development (NPD). In this paper, we first describe the NPD process as an essential strategic process. Following this general description, we describe some of the ways in which accounting plays an important role in NPD.

The Need for New Products

First, we need to clarify the term "product." The APICS Dictionary defines a product as "any good or service produced for sale, barter, or internal use (Blackstone 2008). In recent years, the definition of product expanded to include the combination of goods and services. Very few goods are sold today without being combined with a variety of services. Some writers suggest that the combination of goods and services should be expanded to provide an "experience" for the consumer (Pine and Gilmore 1999). A visit to Disney World, or a train ride through the Rockies, is more than food and rides; it is an unforgettable experience. Because of this expanded view of products, the job of developing new products is becoming more complex and requires a combination of talents and resources to accomplish successfully.

In addition, product life cycles are decreasing. At one time, companies could expect a successful product to last several years, with only minor tweaks being required to keep it fresh in the minds of users. Today, many product life cycles of months, or even weeks, are becoming the new normal. Rising expectations of customers and global competition is placing new demands on companies to bring new products to market faster and continuously.

What percentage of a company's revenues came from new products last year? What will be the percentage next year, or ten years from now? Many companies are finding the need for new products requires a continuing effort in new product development (NPD). In this paper, we describe the NPD process as an essential strategic process. Following this general description, we describe some of the ways in which accounting plans an important role in NPD.

Combined with shortened product life cycles, it becomes clear that NPD is not a task that can be treated as an "as needed" effort, but must become a continuous management function if a company is to be successful. In the past, companies could funnel 100 new ideas into their product development process and be elated if one or two new products emerged, after months or years of bouncing around in the process. This approach is not good enough today and will certainly be inadequate in the future. Companies have to find ways, to not only shorten the time from concept to market, but also reduce the risk of unsuccessful efforts.

Drivers of change

What is driving the need for more new products? There are at least three: global competition, increasing consumer affluence, and environmental concerns.

Both trade and academic publications stress the impact of increased global competition. As a result, products have to meet several requirements, including competitive costs, high and sustained quality, fast response times and flexibility in design and operation. It is no longer good enough to have just low prices; it is necessary to meet all of the new product requirements, although the emphasis may change from market to market.

Consumers are becoming more affluent, in all parts of the world. Even in emerging countries, there is a growing market for products of all types and configurations. Whether the result of different cultures, income levels, or other uniqueness, consumers desire different products.

There is increasing awareness of the need to be more mindful of the effect of products on the environment. This requires several new considerations in designing products:

- Eliminate hazardous materials (computers)
- Make products and their components recyclable at their end-of-life (appliances)
- Reduce the carbon emissions during product use (automobiles)

See Crandall (2006 and 2009) for additional information and references.

NPD Orientation

Because of the above drivers, companies are feeling the pressure to develop new and better products - faster. One approach is to increase the success rate of their NPD efforts by being sure the product being developed is what the customer wants and will buy.

In his book *Adaptive Enterprise*, Stephan Haeckel (1999) encourages companies to move from a “make and sell” orientation to one of “sense and respond.” Table 1 shows his distinction between the two approaches.

Table 1. Make-and-Sell versus Sense-and-Respond

Make-and-Sell	Sense-and-Respond
Assumption: Predictable, continuous, linear change	Assumption: Unpredictable, discontinuous, non-linear change
Goal: Become an efficient enterprise	Goal: Become an adaptive enterprise
Approach: Operate as a closed system without considering external signals	Approach: Operate as an open system considering external signals

Haeckel points out there are fundamental differences between the Industrial Age economy and the Information Age economy; therefore, a fundamentally different kind of business organization is required. As shown in Table 1, the future will require companies to manage in an unpredictable environment. The NPD process must consider not only what the customer needs but also the changing environment in which the products will be used.

A similar approach presented by Conley (2008) outlines moving from product-centric to context-centric. He describes the scope of product-centric as including product functions, features, benefits, price, value proposition and variations. In contrast, context-centric includes the business environment, relationships, other products, interactions, processes, activities, and the people involved. He believes the contextual orientation broadens a company's view while maintaining a connection to what matters to its customers.

Another useful distinction is between product attributes and benefits. Attributes are features, functionality, and performance, or the things that are designed into the product. Benefits are what customer or users value and are willing to pay for – ease of use, durability and the like. Often, benefits and attributes are aligned; however, sometimes the designers get it wrong, so that the added product features and performance do not yield additional benefits for customers or users (Cooper 2005).

Each of the above approaches highlights the need for companies to become more aware of “the voice of the customer.” (Crandall 2010) The costs and risks of failure are too high for companies to ignore; they must address the potential of better NPD methods (Crandall 2009). Determining what the customer wants or needs is difficult, because customers often are not able to express their needs or wants in a meaningful way. Quantitative methods of information gathering are used extensively, such as preference surveys, attribute experiments, and in-market-based research. The quantitative methods are supplemented with qualitative methods such as industry analogies, focus groups, and ethnography (careful monitoring and observations of actual product/service users in live-use settings) (Boike, Bonifant and Siesfeld 2005).

In explaining the difficulty of discovering what the customer needs, Oliver Julien, former product design specialist at Ford Motor Company and co-owner of Design Concepts, an award-winning product design company, describes the process of directly observing how users “cope” with the limitations of the product they are presently using. How do bill payers organize, or reorganize, their workplace to enable them to write checks and file documents? How do individuals with both hands full open a door that only opens inward? Once problems can be detected and corrected, the benefits are obvious – back-up sensors on cars to avoid obstacles that cannot be seen in the rear-view mirrors (Julien 2010)

Strategies

What are the basic kinds of new products? Table 2 shows one classification and a comparison between best performing companies and worst performing companies.

Table 2. Types of New Product Development (percentage of total NPD projects)

Type of Product	Best Performers	Worst Performers
Promotional developments and package changes	6%	13%
Incremental product improvement and changes	29%	40%
Major product revisions	25%	19%
New to the business products	24%	20%
New to the world products	16%	8%
Total NPD Projects	100%	100%

Adapted from Cooper (2005)

As shown in Table 2, the best performers spend more of their resources in developing major product revisions and new products (65%) as contrasted with the worst performers, who devote only 47% in major revisions and new products.

Christensen (2003) has also written extensively about the need for companies to avoid the trap of only making incremental improvements in existing products, and reserve some of their resources to develop disruptive products, which can displace existing products, even those that are leaders. Pine (1993) and others have written about the need to move toward mass customization of products. Often, existing product designs make it impossible, or impractical, to modify production processes enough to achieve customization. Consequently, it is important that new products be designed with the flexibility to be customized for different customer requirements.

New Product Portfolio

In order for new product planning to be successful, it should be an ongoing process, both at the strategic and tactical levels. One way of providing continuity in NPD is by developing a new product portfolio. There are two primary objectives of portfolio planning.

The primary objective of portfolio planning is to transform the business strategy of a company into effective and specific new product investments. These investments should be directed at products that will create growth in revenues and profits, and increase the company's competitive strength, both now and in the future.

A secondary objective is to provide strategic guidance to the firm's various capability development activities, such as:

- Hiring new employees
- Training and developing the entire workforce
- Gaining new tools for product design and development
- Developing new business processes
- Adding new manufacturing abilities
- Developing new strategic partnerships.

Achieving this second objective ensures the firm will steadily improve its capability to develop the needed new products. New product portfolios require continuous review and careful resource management (Patterson 2005).

Methodologies

A number of methodologies facilitate more effective new product development.

- **Participative design/engineering** – A concept that refers to the simultaneous participation of all the functional areas of the firm in the product design activity. Suppliers and customers are often included. The intent is to enhance the design with the inputs of all the key stakeholders. Such a process should ensure that the final design meets all the needs of the stakeholders and should ensure a product that can be quickly brought to the marketplace while maximizing quality and minimizing costs. Syn: co-design, concurrent design, concurrent engineering, new product development team, parallel engineering, simultaneous design/engineering (Blackstone 2008)
- **Quality function deployment (QFD)** – A methodology designed to ensure that all the major requirements of the customer are identified and subsequently met or exceeded through the resulting product design process and the design and operation of the supporting production management system. QFD can be viewed as a set of communication and translation tools. QFD tries to eliminate the gap between what the customer wants in a new product and what the product is capable of delivering. QFD often leads to a clear identification of the major requirements of the customers. These expectations are referred to as the voice of the customer (VOC) (Blackstone 2008). See also Crandall (2010).
- **Design for manufacture and assembly (DFMA)** – A product development approach that involves the manufacturing function in the initial stages of product design to ensure ease of manufacturing and assembly (Blackstone 2008)
- **Product Lifecycle Management (PLM)** - Sussman (2002) defined product lifecycle management as “the marketplace name for the comprehensive framework of technology and services that permits extended product teams – inside and outside of an enterprise – to collaboratively conceptualize, design, build, and manage products throughout their entire lifecycles.” This definition pointed out two primary objectives of PLM – a technology to manage information and a

concept to promote collaboration among departments within a single company or between separate companies.

- **Distributed New Product Development (DNPD)** – The separation and optimization of activities performed during a single product development process (i.e., product ideation, development, launch), across multiple geographic locations. These locations may be within a single corporate entity, be within subsidiaries, or involve the use of third parties (Heck and Grewal 2005).
- **Stage-gate process** – A systematic new product framework with the following major stages in the new product development process: Discovery, Scoping, Build business case, Development, Testing and validation, Launch, and Postlaunch review. Each stage consists of a set of concurrent, cross-functional and prescribed activities, undertaken by cross-functional teams. A set of deliverables is the result of each stage, which must be evaluated and approved before the project moves to the next stage (Cooper 2005).

Role of Accounting in NPD

What, then, is the role of the accounting function in NPD? Is it an outsider looking in, or a full participant in the NPD process? We believe the latter is the correct role and offer the following ways in which accountants can help make the NPD process more successful.

Accounting is generally thought of as the source for quantitative numbers that describe a company's current financial condition and prospects for the future. While it works largely in dollars, or some other currency, it must be prepared to convert other physical measures – hours worked, units sold, units produced, returns, scrap, days of inventory, warranty claims, and a host of other measures of operations – into dollars. Consequently, accounting must be the source of reliable and readily available information about existing products. .

As a member of a cross-functional NPD team, accounting must be able to use past information in assessing the potential for new products. They will be the converter of information from marketing, engineering, operations, human resources and other involved functions, into reliable and official financial projections for new products being developed.

In addition to collecting and compiling information from a variety of sources, accounting must also be able to provide information to their sources in a meaningful and timely format. Other functional representatives may not be agile in reading conventional financial reports; therefore, accounting must provide information in a format that users can understand and apply.

In the early stages, the NPD team needs sufficient information to continue its efforts, or to kill the project as not worthy of pursuit. Accounting must develop reasonable estimates of the project's potential. The numbers need not be precise; however, they must be reliable. Pursuing a likely failure wastes resources; killing a potential success is potentially disastrous. This requires an accountant with both competence and courage.

Sometimes readily quantifiable information will not be available. In this situation, the analysis to proceed with a new product may involve time-to-market requirements, technology status, and customer needs, in addition to cost management requirements. Accounting must play a leading role in organizing these additional variables in a logical and meaningful format to facilitate the decision-making process.

At times, accounting must temper the enthusiasm of marketing in their zeal for new products, or engineering in their confidence of performing technical miracles, with reality. In this situation, accounting must be able to blend facts with diplomacy, to steer the team toward workable goals without shutting off innovative ideas and a collaborative environment.

At some point in the NPD process, accounting must establish cost and profit targets. Target costing has been around for several decades and is an outgrowth of Japanese management developments. Target

costs and profits must be realistic and attainable. These financial goals must be supported with sufficient detail, but in a flexible format to be adapted to the changing conditions and discoveries that are bound to occur. Some of the specific targets needed include:

- Revenues – unit selling price and unit volume. This requires a close working relationship with sales and marketing.
- Product costs – materials, direct labor, and variable overhead. This requires close working relationships with product engineering, operations and human resources functions.
- Process costs, including the investment cost for new equipment and facilities. This requires close working relationships with manufacturing engineering for process requirements, and finance, to determine cost of financing the added capital investment.
- Effect of potential outsourcing. Today, many companies are outsourcing parts of their operations, usually to gain reduced product and investment costs. Accounting will have to evaluate the potential effect of outsourcing.

While balancing needs and wants of other functional areas within the company, accounting will also be communicating with senior management and incorporating their decisions and modified objectives in the NPD process.

It is realistic to expect that accounting will not only perform a technical function concerning information flow but will also play a mediating role in keeping the NPD team on target.

Other Considerations

The NPD process imposes new requirements on a company. Cross-functional teams are a given. Marketing is an essential player in NPD and they have homework to do if they are to be a contributor to the NPD process. They must capture the essential needs and wants of customers and other stakeholders, and then meet with engineering and operations people to translate those needs into appropriate, and profitable, products.

Supply chain collaboration along the supply chain is necessary, both downstream with customers and upstream with suppliers. A superefficient supply chain is meaningless if the right products are not available.

Companies must truly be concerned about the voice of the customer. Recent examples of questionable corporate practices in real estate and financial institutions strongly suggest that these companies were more interested in “make and sell” than “sense and respond.”

The effects of outsourcing, especially offshore outsourcing, will have a profound effect on NPD. The DNPD approach described above is one approach to dealing with widely dispersed participants in the NPD process.

Knowledge management is another vital part of NPD, not only within the company but also with its partners. Knowledge developed at the new product design stage must somehow be preserved for use throughout the product’s life cycle, including the reverse logistics phase.

Finally, the NPD process involves a great deal of project management, whether with individual products or the management of the product portfolio. If a company cannot manage projects, it has little chance of having an effective NPD program.

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PRIVATE COMPANY FINANCIAL REPORTING: ALTERNATIVES TO ACCOUNTING STANDARDS FOR PUBLIC COMPANIES

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INTRODUCTION

An important issue in the area of professional accounting standards, as well as one of long-time debate, is whether privately held companies should be held to the same U.S. generally accepted accounting principles (GAAP) that are required for publicly held companies. The purpose of this paper is to discuss what is currently being done to address this issue, in particular by the Blue Ribbon Panel (BRP) on private company financial reporting supported by the major financial accounting standard-setting boards. Included in the discussion are several models of financial reporting standards for privately held companies, as well as the preferred makeup of the board responsible for setting standards for private companies. The paper follows the Blue Ribbon Panel's deliberations, provides the reader with insights into their preferences, and gives a preview of what deliberations and processes are planned for the future.

BLUE RIBBON PANEL ON PRIVATE COMPANY REPORTING

The issue concerning whether one set of financial reporting standards is appropriate for both private and public companies, which may significantly differ in size and complexity, has been discussed and debated for many years. In 2009 the Financial Accounting Foundation (FAF), which oversees the administration and finances of both the Financial Accounting Standards Board and its counterpart for state and local government, the Governmental Accounting Standards Board, hosted a number of open forums and input sessions on the issue.

As noted in an interview (DeFelice, March, 2010) by Alexandra DeFelice, senior editor of the AICPA's *Journal of Accountancy*, with Panel chairman Rick Anderson, one of the primary thoughts that came out clearly from the resultant feedback was that private company constituents such as owners and bankers may not be provided with useful information about the private companies—and furthermore that currently required information may not be cost-effective for preparers. Similar feedback was heard through similar input sessions solicited by the AICPA. Three sponsoring groups decided that the best way to address this increasingly vocal topic was to form a brand new panel, representing a broad base of constituents, and to deliberate it strategically.

In order to study the issue of financial accounting standards for privately held companies, in December 2009 an 18-member Blue-Ribbon Panel was formed as part of a joint effort by the American Institute of CPAs (AICPA), the Financial Accounting Standards Board (FASB), the Financial Accounting Foundation (FAF), the FASB's parent organization, and the National Association of State Boards of Accountancy (NASBA). In January, 2010 Rick Anderson, chairman and CEO of Seattle-based Moss Adams LLP, was named chairman of the panel who would be charged with studying the issue and making official recommendations about it to the FAF. The Panel's recommendations would also be directed to appropriate boards, bodies related

to professional accounting standards, as well as constituents of private company financial reporting, including user groups, preparers, and practitioners associated with the statements. Panel members represented a cross section of financial reporting constituencies, including lenders, investors, and owners, in addition to preparers, auditors and regulators.

BLUE RIBBON PANEL WORK SEEN AS IMPORTANT TO PROFESSION

As noted by Robert R. Harris, Chairman of the AICPA, in an interview with the AICPA on October 4, 2010, privately held companies play a vital role in our economy—and there are more than 29 million private companies in the United States, including 7 million small- to medium-size businesses. Accounting professionals have voiced concern for many years that these private companies have financial reporting needs that are much different from those of larger publicly held companies. According to Harris, “Their financial statement users need straightforward, understandable information that addresses what they need to know – no more, no less. Given private companies’ key role in job creation and economic development, it’s more vital than ever that their financial statement users and other stakeholders, such as owners of those companies, have the most relevant and useful financial information we can give them.”

U.S.GAAP NOT MEETING NEEDS OF PRIVATE COMPANY USERS/PREPARERS

Panel members have expressed what many accountants agree are legitimate and broad-based concerns about whether current U.S. GAAP and the current process setting financial accounting standards are meeting the needs of the user constituents as well as the preparer company, and practitioners involved in privately held companies. Panel members have heard, and prior research has suggested, that whereas users may not on an overall basis be dissatisfied with current U.S. GAAP, they understand the preparer/practitioner concerns, especially the cost/benefit issues related to some GAAP standards. Certain complex accounting standards do not really provide a benefit to users of privately held companies—and certainly not a benefit to justify the cost. As Panel members and meeting guests have testified, the benefits of these Standards do not justify the associated costs to the private company.

Panel members have expressed a willingness to learn a “new language” of GAAP consisting of different and simplified language geared toward private companies. These standards would be designed to meet the needs of the users of private companies’ financial statements, but at the same time consider preparer and practitioner concerns, including cost benefit considerations. Panel members have noted that the separate, sometimes different needs and concerns of privately held companies versus public companies, have not previously been identified, resulting in private companies having to adopt certain standards that lack relevance to users of private company statements.

PANEL MEMBERS ADVOCATE RELEVANCE TO USERS

With the above in mind, at their July, 2010 meeting, the Panel made it their No. 1 priority to select a model that would produce financial accounting standards that are relevant to users of financial statements. As reported in the September, 2010 issue of the Journal of Accountancy by

Alexandra De Felice, Panel members' July, 2010 comments included responses from several key individuals:

Panel Chairman Rick Anderson, chairman and CEO of Moss Adams LLP, and a current FAF board member, "Relevance is the overriding issue. It's impacted by complexity, cost/ benefits [and consistency] Does this make the financial statements more useful and better for the intended audience of those statements? [If so] we'd be moving in the right direction. Relevance—its' the word and concept that cuts across all of this." Summarizing previous meeting discussions, Anderson said "Users were not in love with all of the GAAP standards that exist today. They take financial statements in accordance with GAAP and make adjustments. If standards change, they could live with that. They are open to different standards as long as there are legitimate reasons for different standards."

Panel member Dev Strischek, senior vice president and senior credit policy officer of corporate risk management for Sun Trust Banks Inc. said "If the changes are relevant and reasonable, users will get the information they need, even if that means certain differences between public and private company GAAP."

Panel member Krista McMasters, CEO of Gunderson stated "[But] when the most complex issues are the least relevant and most costly, we need to deal with that." She continued by indicating that the "most troubling" issue is the increased number of users she sees accepting "except for" qualified audit opinions and stated "When generally accepted accounting principles isn't accepted any more, that's troubling."

MODELS FOR DEVELOPING AND IMPLEMENTING FINANCIAL REPORTING STANDARDS FOR PRIVATELY HELD COMPANIES

After studying seven models for setting private company standards prepared by the panel's staff, at the July, 2010 meeting, the Panel decided to focus on three primary models for further study and consideration. The Panel took the approach of eliminating from consideration for privately held companies financial standards models based on international financial reporting standards (IFRS). As reported in the *Journal of Accountancy*, the models chosen for further consideration are:

- U.S. GAAP With Exclusions for Private Companies—With Enhancement
- U.S. GAAP—Baseline GAAP with Public company Add-Ons
- Separate, Stand-Alone GAAP Based on Current U.S. GAAP

In the first model "U.S. GAAP With Exclusions for Private Companies—With Enhancement" current U.S. GAAP would be used by all companies, with improvements coming from the FASB's normal standard-setting process. However differences such as exclusions would be allowed for private companies. The potential benefits of this approach of having one primary GAAP with certain differences is that it provides for more consistency and comparability between public and private companies than do the other models. However potential drawbacks of

this approach are that because this is an exception-based approach, the FASB due process procedures may not allow for concerns to be heard of the privately company.

In the second model,” U.S. GAAP—Baseline GAAP with Public company Add-Ons,” current U.S. GAAP would be reviewed and reorganized into a baseline GAAP for all entities based on user needs, and additional GAAP requirements (“add-ons”) would be made for public companies. The potential benefits of this approach are that it could significantly reduce the complexities for private companies since the focus would shift to why users of public companies need certain information, rather than why users of private companies do not. A major drawback is that the practicality of this approach is questionable.

In the third model, ”Separate, Stand-Alone GAAP Based on Current U.S. GAAP,” current U.S. GAAP would be reviewed, modified and developed into a comprehensive, self-contained set of financial accounting standards for private companies. The potential benefits of such a approach is that it permits a more exclusive focus on the needs of users of financial statements of private companies. However potential drawbacks are that it could be more costly to convert from private company to public company financial statements, should the need arise.

The Panel invited all interested constituents to comment on the above alternate reporting models. Specifically the Panel asked for public comments based on a series of questions relating to the alternative financial reporting models. The Panel emphasized that it was seeking feedback from users of private company financial statements, as well as from preparers and practitioners.

FOCUS NOT ON IFRS FOR PRIVATE COMPANIES STANDARDS

Although there is much current focus in the accounting profession on international financial reporting standards (IFRS), the panel members are basically of the viewpoint that incorporation of IFRS into private company financial reporting is not necessary because most private companies are not at the point where they are ready for IFRS. The panel rejected two models based on IFRS. As reported in the September, 2010 *Journal of Accountancy* article, according to the author and periodical’s senior editor Alexandra DeFelice, “Many members indicated that while the U.S. ultimately may move to IFRS, the chosen model could evolve to encompass those changes.” However the also author notes that the overall consensus of the panel was that adoption of IFRS would not happen within the near future of five years, based on current estimates and the SEC roadmap—and that “focusing on a standard-setting process that could result in warranted differences sooner was more important.”

MAKEUP OF GROUP SETTING PRIVATE COMPANY STANDARDS

Another major issue on which the Panel deliberated was the makeup of the Board which would have responsibility for private company financial standards. Members of the Panel have expressed the viewpoint that the group that sets standards for privately held company must understand the needs of the groups who will be using statements they design. Probably rightly so, the current the focus of the FASB is on public companies rather than privately held firms. However the FASB’s emphasis on public over private causes a problem for the privately held. Therefore an important aspect of the Blue Ribbon Panel’s deliberations has been the structure of

the standard setting body for private companies, an important question regardless of which of the above models is selected. Thus, the Panel has included in its deliberations whether the group responsible for setting privately held accounting standards should be the current FASB board, a restructured FASB board with greater private company representation, or an entirely new separate Private Companies Standards Board under the oversight of the Financial Accounting Foundation

OUTCOME OF FURTHER DELIBERATION –“EXCEPTIONS” MODEL AND SEPARATE BOARD TO SET PRIVATE COMPANY STANDARDS

As reported at fasb.org, at their October 8th, 2010 meeting at the AICPA’s New York City’s office, their fourth public meeting, the Blue Ribbon Panel announced that a majority of members believes that there is a need for a standard-setting model that basically follows U.S.GAAP, but allows for exceptions for private companies. This approach is that recommended by the first of the three models outlined above. In addition the Panel recommended that private company standards be under a separate private company standards board under the oversight of the Financial Accounting Foundation. As reported in a news release of the FAF (October 8, 2010) Barry Melancon, AICPA president and CEO, stated his reaction, “On behalf of the AICPA members working in the private company arena, I’m pleased the majority of the Panel members supported the bold step of a new, separate private accounting standards board under the FAF’s oversight. An important benefit of having a new board is to help ensure the needs of the private company sector are appropriately addressed in the standard-setting process.”

FINAL PANEL RECOMMENDATIONS

The BRP presented a report of its recommendations at its fifth meeting on December 10, 2010 at the FAF offices in Norwalk, Connecticut, and confirmed its earlier consensus for the creation of a new separate private company standards board under the oversight of the Financial Accounting Foundation, and the exceptions model providing for modifications of U.S. GAAP for private companies.

As reported in the FAF press release (December 10, 2010) , the Blue Ribbon Panel addressing how U.S. accounting standards can best meet the needs of users of private company financial statements reaffirmed a consensus view reached in October that a separate private company standards board be created under the under the oversight of the FAF. At the meeting, the panel continued study of a new standard-setting model which follows generally accepted accounting principles but provides for exceptions for private companies. In addition the Panel discussed related issues such as how the new board would work with the Financial Accounting Standards Board (FASB) in the standard-setting process, the new board’s mission and structure, and how it would be funded.

As noted by Defelice (December 10, 2010) rather than to issue new standards, The mission of the proposed new board is, “to establish exceptions and modifications to U.S. GAAP for private companies, while ensuring that such exceptions and modifications provide decision-useful information to lenders and other users of private company financial reports” Defelice notes how panel members emphasized the word “lenders” which demonstrates how this board would be

different from FASB—since lenders constitute the largest user base of private company financial reports

FUTURE DELIBERATIONS AND CONCLUSIONS

As reported by the AICPA (December 10, 2010), “Historic change is on the horizon for many of the nation’s 29 million private companies and small businesses.” The FAF plans to consider the BRP report at its February 15th meeting and then release proposals for public comment. The AICPA supports the Panel’s recommendations and has urged its members to write comment letters, encouraging CPAs, lenders and other users, private companies, and small business owners to be actively involved in the process in order to “be engaged in this critically important initiative to help transform the recommendations into reality.” We concur with the AICPA that the time has come to recognize the different needs of users of financial reporting for private companies from those of public companies—and that GAAP for public companies is at times not appropriate for private companies. We urge our colleagues both in academia and in the profession to take notice of this issue, participate in the discussion, and voice their opinions.

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USEFUL INFORMATION FROM KNOWLEDGE RETENTION ASSESSMENTS:
ANALYSIS OF RESULTS IN INTERMEDIATE ACCOUNTING AND AUDITING COURSES

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ABSTRACT

This paper tells the story of an accounting department at a mid-size southeastern state supported university to integrate key assessment material into required accounting courses in its BBA Curriculum for the accounting major. Assembly to Advance Collegiate Schools of Business (AACSB) Accreditation was a main driver of the Department's search for mechanisms to design and implement effective assessments. The authors are interested in satisfying institutional requirements to comply with continuous accreditation, but also in effecting learning gains for the accounting majors going through the BBA curriculum. Accordingly, the focus of this research is on practical attainment of learning progress as measured by learning outcomes. Comparison to achievements in prior accounting and general education courses can then be used along with other factors to predict student success in current course work. The authors pursued a path of development of Knowledge Retention Assessments (KRAs), administered on both a PreTest and PostTest basis in all sections of Intermediate Financial Accounting II and Auditing & Assurance Services during calendar year 2010.

INTRODUCTION

The University does not currently have a graduate program in accountancy, but does boast a strong BBA program with majors in Accounting, Management, Marketing, Supply Chain Management, and General Business. The School of Business also has an MBA program with a Supply Chain Management Major. This paper attempts to describe key trends in enrollment and performance in the undergraduate Accounting Major for the BBA degree, by applying key assessments during the first week of classes in dedicated courses. The results can provide a fair warning to students about the information they should have mastered from prior courses and provides meaningful information to faculty for modifying course structure while still addressing course-learning outcomes and working toward overall curriculum enhancement. Armed with this information, curriculum and program development can be guided by better policy decisions.

REVIEW OF RELEVANT LITERATURE

Shaftel and Shaftel (2007) summarize the primacy of having an accounting program totally in line with current AACSB standards along with specific assessment components. The accounting major is expected to perform at a sufficiently high level at most universities in accordance with predetermined learning outcomes for either each course or the program as a whole. Among those outcomes is communication as demonstrated by Borzi and Mills (2001). Other pundits and the Accounting Education Change Commission (AECC) note that these deficiencies can impair the success of the accountant in practice. Beard, Schwieger, and Surendran (2008) also point to the importance of a comprehensive set of skills that should be assessed, but they focused also on the soft skills.

The authors of this paper agree that the soft skills are important, but should not upstage the minimum expected course learning outcomes associated with the accounting business knowledge. This is amplified by White (2007) in her remarks that accreditation must focus on the rigorous standards established by the faculty, and that Assurance of Learning must follow from those standards. At the ultimate extreme, measurement of learning assurance might be sought through successful completion of postgraduate programs, or as Barilla, Jackson, and Mooney (2008) point out, successful completion of some postcurriculum experience such as the CPA exam.

The AICPA is interested in promoting a broad business perspective competency. Ammons and Mills (2005) use a broad methodology in applying course-embedded assessments for evaluating cross-functional integration with a target of improving the process of teaching and learning. Accordingly, usage of earlier learned skills and knowledge is expected to be helpful in mastering new material. These prior skills and knowledge areas may include mathematics, communication, and logical critical thinking. Jervis and Hartley (2005) focus on the accounting capstone course as the logical place for the culminating academic experience where all prior coursework is integrated.

It is the first course, financial accounting principles, that plays a major role in calibrating success for graduates of our accounting programs. Chen, Jones, and McIntyre (2004) demonstrate, irrespective of whether a student is a major or a non-accounting major, the content and delivery of that first course is instrumental for success of the student in a business curriculum. Furthermore, Kopf (2003) points out that a major benefit of assessment lies in identifying the gaps between what students expect and what institutions or specific educators deliver. Other researchers also give high marks to the process of assessment in that it can be employed as a teaching and learning tool, not just an assessment tool (Shoulders and Hicks (2008), and it provides a performance indicator for both students and staff, especially when it is done in an electronic environment with rapid feedback to the students (Marriott (2009)). Many of these researchers provide examples of the importance of a pre-course diagnostic assessment to assist in guiding the process.

KNOWLEDGE RETENTION ASSESSMENT (KRA) METHODOLOGY

The AACSB proposes two major methods of assessment—indirect and direct. The indirect includes surveys, evaluations, and softer instrumentation. The direct method of assessment implies key testing of knowledge or other learning outcomes during the program experience. While we have a dedicated Major Specific Exit Exam for accounting majors at the culmination of the BBA program, we also actively employ course-embedded assessments for each course in the accounting major. In some courses, we are particularly interested in the background foundation of the students in the class and administer a knowledge retention assessment (KRA). The students take the test online during the first two days of classes and receive their grade results immediately. Students are given guidance of cutoff scores being relatively risk-free for success in the current course, or moderate risk, or high risk. Students that score at high risk are encouraged to consider effecting a course change for the current semester. If necessary, students are asked to engage in further analysis for their probability of success in the current course,

hopefully identifying factors which may have contributed to low performance results, and providing guidance for areas students should work on to fill gaps in their knowledge base.

Key sites selected for analysis were two courses—Intermediate Financial Accounting II and Auditing & Assurance Services. We replicated the experiment over two consecutive semesters, Spring and Fall, 2010. The replication further achieved balance through oscillation of day and evening sections: during the Spring semester, both sections were evening while during Fall, both sections met during the day. All four sections were taught by the same instructor. Principles of Financial Accounting with a grade of B is a prerequisite for Intermediate I. Grades of C are the minimum in all courses beyond the Principles courses. Intermediate I is a prerequisite for Intermediate II, which in turn is a prerequisite for the Auditing course. The background students obtain in these prior courses is assumed essential. Accordingly, the researchers were interested in correlating those prior course grades, as well as overall GPA, along with the KRAs (pre and post) in this study.

The Principles course grade must have been either an A or a B in accordance with Catalog requirements (holds for either native or transfer students). We wanted to control for the effects of transfer students since nearly half of our accounting majors had one or more of their two accounting principles courses at another institution. The prerequisite grade is that grade earned in the preceding course—for Intermediate II that would be Intermediate I; for Auditing, that would be Intermediate II.

THE KRA INSTRUMENT

In order to view trends in change over the course of the term, the KRA was administered twice in each section—the first and last days of the course. Students were advised to do well on the PreTest for guidance, with no positive points awarded, only a penalty of one letter grade for the course for failure to submit. The PostTest was conducted as an add-on to the final exam with bonus points. A 50-question multiple choice test with four answer stems with only one being correct was established. To capture the fundamental quantitative and qualitative aspects, the Learning Outcomes were identified with a mix of questions shown in Figure 1.

Figure 1. KRA Outcomes and Question Count

Outcome Number	Outcome Name	Number of Questions
1	Logical Thinking	5
2	Written Communication	5
3	Arithmetic	5
4	Algebra	5
5	Accounting Principles	10
6	Intermediate Acct I	10
7	Intermediate Acct II	10
Total		50 Questions

The questions involving logic focus on inductive and deductive reasoning and the recognition of fallacies. The written communication questions emphasize the importance of voice, tense, person, and paragraph development. Arithmetic calculations include simple averages and percentages. Algebra questions require solutions for a single variable. The accounting questions developed carried double the amount in the weighting so the test instrument would have 60% devoted to pure accounting. The Principles of Financial Accounting include bookkeeping journal entries as well as financial statement presentation. The Intermediate Accounting questions emphasized recognition and measurement as well as presentation and disclosure. The instrument was designed to be approximately equal balance of quantitative calculation answers and theoretical, conceptual questions.

TESTING RESULTS – LEARNING OUTCOMES

The 50-question instrument makes for readily visible useful results by applying two points worth to each quest. Our University Center for Instructional Development provided guidance in downloading question results attached to Learning Outcomes from GeorgiaView (Blackboard) into Excel. Insertion of subtotals for each of the seven learning outcomes provides the meaningful analysis. Table 1 shows the results of Intermediate Accounting II during the 2010 year.

Table 1. 2010 Intermediate Accounting Results by Learning Outcome

Learning Outcome	Spring PreTest (n=29)	Spring PostTest (n=23)	Fall PreTest (n=27)	Fall PostTest (n=26)
1. Logic	75.0	87.8	62.3	66.9
2. Written Communication	67.5	80.9	45.4	53.8
3. Arithmetic	97.5	95.7	96.9	91.5
4. Algebra	92.5	93.0	86.9	83.1
5. Accounting Principles	81.3	65.7	72.7	65.8
6. Accounting Intermediate I	63.8	50.9	46.9	49.2
7. Accounting Intermediate II	57.5	64.3	40.4	62.3
Mean	61.4	71.9	61.2	65.0
Median	62.0	70.0	63.0	68.0
Standard Deviation	11.7	11.7	7.9	14.3

The loss in number of students between PreTest and PostTest is explained by the number of students who formally withdrew from the course by the midterm and hence did not sit for the PostTest, which is administered as part of the course final examination.

The authors are pleased with the improvement witnessed in Learning Outcome 7, the Intermediate Accounting II outcome (the prime outcome for this course), but are concerned regarding the decreases in Accounting Principles and Intermediate Accounting I between the PreTest and PostTest. Further work is needed to determine if this is attributable to some cause other than student whimsical attitude of short-term fix—memorize the stuff rather than learn it.

Table 2. 2010 Auditing & Assurance Services Results by Learning Outcome

Learning Outcome	Spring PreTest (n=18)	Spring PostTest (n=16)	Fall PreTest (n=10)	Fall PostTest (n=10)
1. Logic	67.8	68.8	78.0	86.0
2. Written Communication	56.7	63.8	66.0	66.0
3. Arithmetic	98.9	98.8	98.0	92.0
4. Algebra	88.9	88.8	90.0	84.0
5. Accounting Principles	74.4	81.3	70.0	73.0
6. Accounting Intermediate I	48.9	53.1	51.0	51.0
7. Accounting Intermediate II	55.6	52.5	51.0	45.0
Mean	67.3	69.4	67.6	66.6
Median	66.0	69.0	64.0	67.0
Standard Deviation	12.1	11.7	16.3	15.4

The results of Table 2 show the Auditing course with more stability in Accounting Principles and Intermediate Accounting I between respective PreTests and PostTests, but of concern is the most recent prerequisite course, Intermediate Accounting II, where there is decline in both the Spring and Fall sections.

TESTING RESULTS – OTHER FACTORS

The authors are also interested in evaluating the effect of the Accounting Principles Course, which is the prerequisite course for Intermediate Accounting I (for Intermediate Accounting II, the prerequisite is Intermediate Accounting I; for Auditing, the prerequisite is Intermediate Accounting II), and overall GPA, on the final course grade in the four course sections studied.

Table 3 shows the average effect on Principles of Financial Accounting where it is seen that over one-third of our students in all sections took at least one attempt of Accounting Principles at another institution. That rate declines for transfer credit, as students with less than B grade must re-take the course. On the average, students take the Financial Accounting Principles course 1-1/2 times before taking Intermediate Financial Accounting I.

Table 3. 2010 Input Factors Analysis—Principles of Financial Accounting All Four Sections

Course & Term	n	Transfer Grade? (1=Yes, 0=No)	Transfer Credit? (1=Yes, 0=No)	# Attempts for Principles Course	Highest Principles Grade
Intermediate, Spring	23	.38	.17	1.52	3.41
Intermediate, Fall	26	.42	.15	1.54	3.42
Auditing, Spring	16	.39	.28	1.56	3.67
Auditing, Fall	10	.60	.50	1.20	3.60

Table 4 describes the impact of the prerequisite course. The table also shows the overall GPA for each course section as well as including the KRA (both PreTest and PostTest) for comparative purposes. The final column shows the class grade. The Spring sections show adjusted course grade to back-out the effect of the withdrawals in those sections, where students did not sit for the final examination.

**Table 4. 2010 Input Factors Analysis—GPA, Prereqs, & KRAs
Correlation to Output (Course Grade) All Four Sections**

Course & Term	Overall GPA	Prerequisite Grade	n	KRA	Course Grade, Adj Grade
Intermediate, Spring	3.12	2.69	29, 23	61.4, 71.9	1.69, 2.13
Intermediate, Fall	3.23	2.69	27, 26	61.2, 65.0	2.58, 2.58
Auditing, Spring	3.24	3.00	18, 16	67.3, 69.4	2.72, 3.06
Auditing, Fall	3.28	2.60	10, 10	67.6, 66.0	2.90, 2.90

Finally, to determine whether the KRA has value in prediction for student success, we isolated the weaker students (D,F,W) from those who were stronger (A,B,C) grades. It appears that relative to Intermediate Accounting II, the instrument holds predictive value. Insufficient sample size for Auditing, the capstone, culminating course in the Accounting Major, suggest further work be done there to draw conclusions.

Table 5. 2010 Correlation of Pretest with Unsuccessful Grade

Course & Term	n	Successful Students (Grades A,B,C)	Unsuccessful Students (Grades D,F,W)	PreTest Unsuccessful Students	PreTest All Students
Intermediate, Spring	29	18	11	54.0	61.4
Intermediate, Fall	27	23	4	54.7	61.2
Auditing, Spring	18	16	2	70.0	67.3
Auditing, Fall	10	10	0	N/A	67.6

IMPLICATIONS FOR STUDENT ADVISING

Our findings reveal that almost half of the accounting majors our University/School admits at the junior level are not our own from accounting principles. Separate studies currently being conducted lead us to believe that a definite weakness appears in the readiness overall by transfer-in students in Intermediate I, but those differences are not as nearly pronounced by the time they take the Auditing course. Advisors need to have greater alert signals sent out for the “new” students as they enter their junior year. Relative to the performance of native students, those taking Principles of Financial Accounting at our Institution, differences are shown to exist at the

adjunct level, but not substantially among the five full-time accounting faculty. Advisors need not direct students to Professor Easy because Professor Easy does not exist.

CONCLUSIONS AND FUTURE RESEARCH

Possible biases include the fact that some students may be sensitized upon taking the Knowledge Retention Assessment in the subsequent course the following semester. When viewing the post-test results over the more basic questions from the freshman/sophomore level, students did seem to learn finally the concepts assessed. We cannot say with any great confidence that this learning is attributable to the additional experience in the most recent accounting course. Or, did that happen because they finally learned a few key specifics by trial and error and perhaps rumor mill among other students?

We believe that the direct assessment methodology using pre-test knowledge assessments, especially when coupled with post-test analysis, provides a useful means of measuring the strength of the program. When back-casting to the Principles of Accounting course experiences, the additional information of what makes for a more successful, or less successful, accounting major is helpful for curriculum development, and can also be of special assistance to individual faculty in evaluating their delivery efforts in the Principles courses. We plan to run additional analysis over future semesters to enlarge our sample and strengthen our testing. We recognize that these results may not apply to those institutions which have a consistent, reliable, steady level of input quality from their Principles courses. We do believe, however, that our efforts are helping us close the loop, not only for AACSB requirements, but also for the learning gains in the academy of which we all are about.

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WORKSHOP INTERACTIVE SESSION PROPOSAL

National Strategy for Trusted Identity in Cyberspace

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Abstract

The U.S. Office of the President has responded to the national problem of identity theft, privacy, and Internet computer crime with a national private/public initiative manifested in two important White House documents:

Cyberspace Policy Review
National Strategy for Trusted Identity in Cyberspace (NSTIC)

This interactive session will explore the benefits and disadvantages and pros and cons of the initiative. The session will begin with a 5-10 minute summary of the cyberspace policy and a 10-15 minute summary of the national strategy for trusted identity, followed by a discussion of the topics among the participants. Relevant handouts will be distributed.

Expected session length: 1-1.5 hours (the length of a nominal conference session)

**“Sex, Stocks and Sports”: Danielle Chiesi and Her
Quest For Inside Information**

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ABSTRACT

This paper briefly defines and discusses insider trading and also describes the forms of insider trading that are illegal in the USA. DC, former teenage beauty queen and stock analyst at the hedge fund New Castle Partners, was arrested on October 16th, 2009 and charged with 17 counts of securities fraud and conspiracy. She was deeply involved in the most prominent of recent insider trading cases, the Galleon Group insider trading scandal. This paper explores various reasons why DC cultivated relationships with insiders and the benefits that she hoped to realize from these questionable relationships.

I. INTRODUCTION

There are two very good indicators regarding the direction that a firm's stock price is heading. One of those indicators is earnings per share (EPS), which predicts both appreciation in value and dividend payments for many firms. The second indicator is insider stock transactions i.e. what are the people who have access to the most information about a firm doing---are they buying or selling the firm's stock? And even if executives aren't selling their shares, is there value in knowing that top management is engaging in hedge transactions designed to protect them if the market value for the stock falls? (Sasseen 2010)

Inside information includes any information that is not available to the general investing public. Research & development successes, sales forecasts, actual sales numbers and gross profit information all precede net income and EPS results. Having access to this information or having contacts with the employees who have access can provide certain investors with enough actionable advance knowledge to engage in proactive selling or buying activities. Often, these activities are of such a magnitude as to move the price of the stock in question.

Followers of conventional wisdom believe that insider purchases send a positive signal and that when insiders are selling, independent investors should follow suit (McKay 2003) (DeFotis 2003).

DC enjoyed the company of older men, especially if they had access to (and were willing to divulge) confidential information about the companies that they worked for. An attractive former beauty queen, she got their attention with "I love the three 'Ss'---sex, stocks and sports". Suggestive and revealing attire further enhanced her ability to gain attention from the men she targeted. (Bandler 2010) Quite frankly, she thrived on acquiring confidential business

information and then profiting from it. Capitalizing on her petite, blue-eyed and blonde good looks were just part of her arsenal of techniques for acquiring information.

II. ANALYSIS AND BACKGROUND

The term “insider trading” certainly possesses a distasteful connotation in 2010. However, insider trading can be perfectly legal. On its website, the SEC defines “insiders” (for insider trading reporting purposes) as the following: Directors, executive officers, and anyone owning 10% or more of any class of the firm’s equity securities. SEC #1 2003) The definition can be expanded for investigation/prosecution purposes. A broader definition of “direct insiders” also includes managers and staff. In addition, an entity’s investment bankers, accountants and auditors, business consultants and lawyers can be defined as “temporary insiders”. Finally, the relatives and friends of the various classifications of direct and temporary insiders can be deemed “tippees” (think Martha Stewart) and also can be charged with insider trading violations. (SEC #2 2003)

Unfortunately, the fact remains that illegal insider trading is comparatively easy to perpetrate but difficult to prove.

One reason for that conundrum is that insiders are allowed to buy and sell the securities of their employer. Proving that a seller had access to material inside information AND he/she used this information when deciding to sell or buy AND acted with scienter (a deliberate intent to deceive) can be difficult, at best. Whereas it may be easy to prove what someone did, it’s a lot tougher to prove what someone was thinking!

An inside trade becomes illegal when information that the trader possesses is material (Fried 1998). Material information is information that a potential buyer or seller would

attach importance to in trying to determine whether or not to purchase/sell the shares. The SEC and other bodies believe that illegal insider trading would undermine investor confidence. This would initiate a chain reaction of sorts. Investors without confidence that the trading system would protect them from others earning unreasonable profits at their expense would be less likely to invest in the market. Fewer investors participating in the equity markets would reduce demand for stocks, thereby driving overall prices and aggregate market value down. DC based her career upon illegally acquiring and using confidential business information.

III. DISCUSSION AND CONCLUSIONS

DC and twenty other co-conspirators were caught up in a federal investigation that was launched in October, 2007. They are accused of reaping tens of millions of dollars in profits on stock trades that they entered into on the basis of inside information. DC was an important player in this scheme as she used her charms to entice top-level contacts at various firms to risk their own careers, reputations and freedom to provide her with confidential information. (Bandler 2010)

During the years leading up to her arrest, DC exhibited an almost uncanny sense of which way stock prices for many technology companies were headed. Unfortunately, rather than relying on skill, knowledge and reliable forecasting techniques, her primary source of information was her network of unethical executives and other employees with access to information at dozens of different companies.

DC was quoted as saying “You do what you do to get information.” (*ibid*) In 2002, she asked to be introduced to an “up-and-comer” at IBM. When Robert Moffat, a former Eagle Scout, 3-time All-American athlete in college, and a workaholic senior VP at IBM, was introduced to her by

IBM's CFO John Joyce in 2002, he immediately fell for her charms. The two entered into a relationship, with Mr. Moffat exchanging inside information for Ms. Chiesi's time & attentions. He didn't receive a single dollar for the information that he provided, nor did he actually engage in any trades of IBM stock. A "classic tale of love and betrayal" (*ibid*), the two were bound by his love for her and her love for the inside information that he could (and did) provide. Chiesi's statement about Moffat "He's a huge coup for me." sums-up her mercenary attitude towards him.

The government doesn't have to prove financial gain to win a conviction for insider trading. It only has to prove that the person engaged in the behavior received some sort of benefit from it. Unfortunately for Mr. Moffat, the affection of an attractive woman qualifies as a "benefit". Moffat tearfully pleaded guilty to conspiracy and securities fraud involving insider information. He admitted to providing DC with insided information about IBM and also about other companies whose board's Mr. Moffat sat on. (Bray, 2010) The convicted felon's dalliance and illegal behavior also cost him an estimated 65 million dollars (the value of lost stock options & IBM pension), and probably his marriage of 32 years, too.

As of September, 2010, 11 of the 21 persons indicted along with DC have pled guilty to some or all of the charges against them. An extensive dossier of emails, tapped phone conversations, and other communications will probably result in convictions for most or all of the remaining defendants. Ms. Chiesi is fighting the charges lodged against her, although the Feds have probably offered to reduce the charges against her in return for her help in convicting the biggest defendant caught up in this case, Mr. Rajaratnam, founder and CEO of the Galleon Group. So far, she has refused to cooperate with the FBI's investigation and she is seeking to have statements that she made on the morning of her arrest suppressed. (Pulliam and Bray, 2010)

If one were to draw a conclusion from all of this, it would be that greed (and other human weaknesses) trumps ethical and moral values. Although this illegal behavior likely will never be completely eliminated, better rules and, most importantly, enthusiastic enforcement would serve to greatly reduce illegal insider trading.

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WHEN WILL THE UNEMPLOYMENT RATE RETURN TO NORMAL?

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ABSTRACT

This project employs a baseline vector auto regression (VAR) model to generate forecasts of real GDP growth and the unemployment rate. The model forecasts relatively rapid short-term real GDP growth, slowing to the approximate long-term rate, and a slowly declining unemployment rate. According to this very simple model, the unemployment rate will fall to 7% by the third quarter of 2013 and to near 6% by 2016.

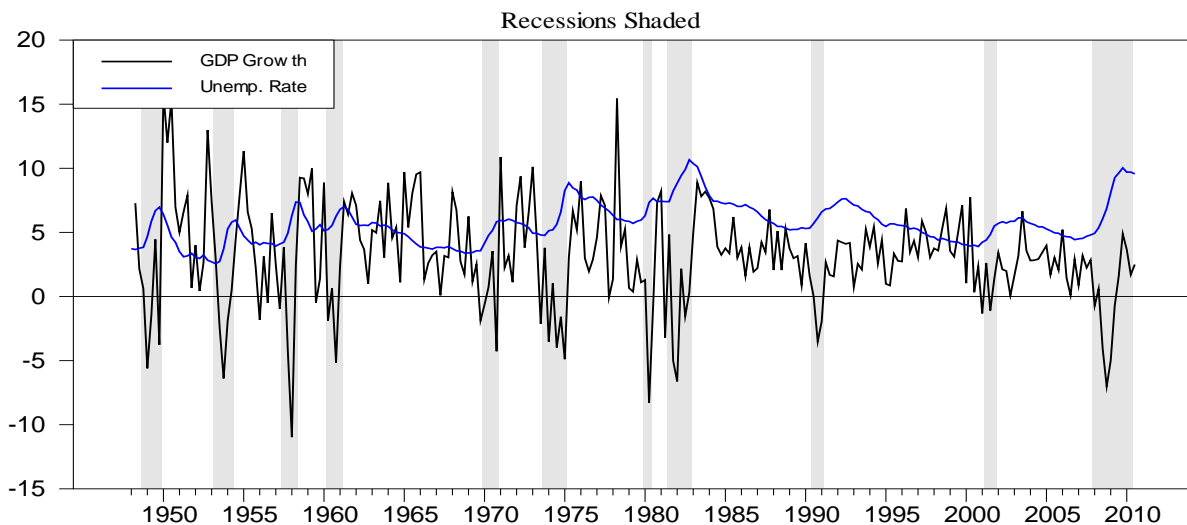
INTRODUCTION

The current recovery from the “great recession” has been called a jobless recovery. The meaning of this phrase is that the economic growth that has taken place in recent quarters has not resulted in a great deal of job creation, and has done little to lower the unemployment rate. It is common knowledge that the unemployment rate is a lagging variable, that is, the unemployment rate responds to economic growth after a significant time lag.

DATA AND METHOD

The data for this project begin in the first quarter of 1948 and extend through the first quarter of 2010. The variables are the growth rate (annualized) of real GDP and the unemployment rate. The unemployment rates are quarterly averages of monthly data. Both series were collected from the US Econ database from Haver Analytics. Figure 1 depicts both series for the entire sample period.

Figure 1: GDP Growth and Unemployment Rate



Given some knowledge of the periods of recession (for example 1980-82, 1990-91, 2001, and 2007-09), it is reasonably clear that the periods following the negative real GDP growth, are periods of rising unemployment, and that recoveries produce declines in the rate of unemployment with a significant lag.

A very simple VAR model is estimated in the form of equation 1.

$$UR_t = a_0 + \sum_{i=1}^p b_i UR_{t-i} + \sum_{i=1}^p c_i GDP + e_t \quad (1)$$

Where UR is the unemployment rate, GDP is the annualized quarterly growth rate of real GDP, t indexes time, e_t is a white noise disturbance term and the b_i and c_i ($i = 1, \dots, p$) are the lag coefficients, and p indicates the order of the lags. Each variable serves as the left-hand side of (1) in a VAR.

I use the Akaike information criterion (*AIC*) to choose the number of lags for the model. The *AIC* can be represented as

$$AIC = (2k / T) + \log(\sigma) \quad (2)$$

where k is the total number of estimated coefficients in the equation, T is the number of usable observations, and σ is the scalar estimate of the variance of the equation's disturbance term. The *AIC* chooses $p = 3$ for the VAR model.

RESULTS

The estimated VAR model suggests Granger causality running from the unemployment rate to GDP and vice-versa (see Tables I and II).

Table I: F-Tests, Dependent Variable: GDP growth

<i>Variable</i>	<i>F-Statistic</i>	<i>Significance</i>
GDP Growth	2.6876	0.0471441
UR	6.4808	0.0003112

Table II: F-Tests, Dependent Variable: Unemployment rate

<i>Variable</i>	<i>F-Statistic</i>	<i>Significance</i>
GDP Growth	10.8903	0.000000
UR	1962.0539	0.000000

The VAR model can produce forecasts for any future number of steps ahead. Here I choose to forecast six years (24 quarters) ahead. Table III contains the forecasts generated from the model.

In terms of behavior, we would expect that the model would predict fairly rapid growth following a deep recession, followed by a gradual return to a normal rate of growth, accompanied by a falling unemployment rate, eventually returning to something near a natural rate of unemployment. The natural rate, often called the “NAIRU” (Non-Accelerating Inflation Rate of Unemployment) is commonly estimated to be slightly less than 6% for the US, though some also believe the natural rate may now be somewhat higher than in the past. The forecasts perform as expected, though most current predictions for near-term growth of GDP would be slower than that predicted by the VAR model. Even given the model’s predictions for robust growth in GDP for the near-term, the forecasts for unemployment rate suggest it will take about four years for the unemployment rate to fall to near 6.5%.

Table III: Forecasts from the VAR

<i>Quarter</i>	<i>GDP Growth</i>	<i>Unemployment Rate</i>
2010:04	4.40	9.41
2011:01	4.67	9.21
2011:02	5.02	8.95
2011:03	5.07	8.65
2011:04	4.99	8.36
2012:01	4.79	8.08
2012:02	4.59	7.84
2012:03	4.41	7.62
2012:04	4.26	7.44
2013:01	4.14	7.27
2013:02	4.04	7.13
2013:03	3.96	7.00
2013:04	3.89	6.89
2014:01	3.83	6.79
2014:02	3.78	6.70
2014:03	3.73	6.62
2014:04	3.68	6.54
2015:01	3.64	6.48
2015:02	3.60	6.42
2015:03	3.57	6.37
2015:04	3.54	6.32
2016:01	3.52	6.28
2016:02	3.49	6.24
2016:03	3.47	6.21

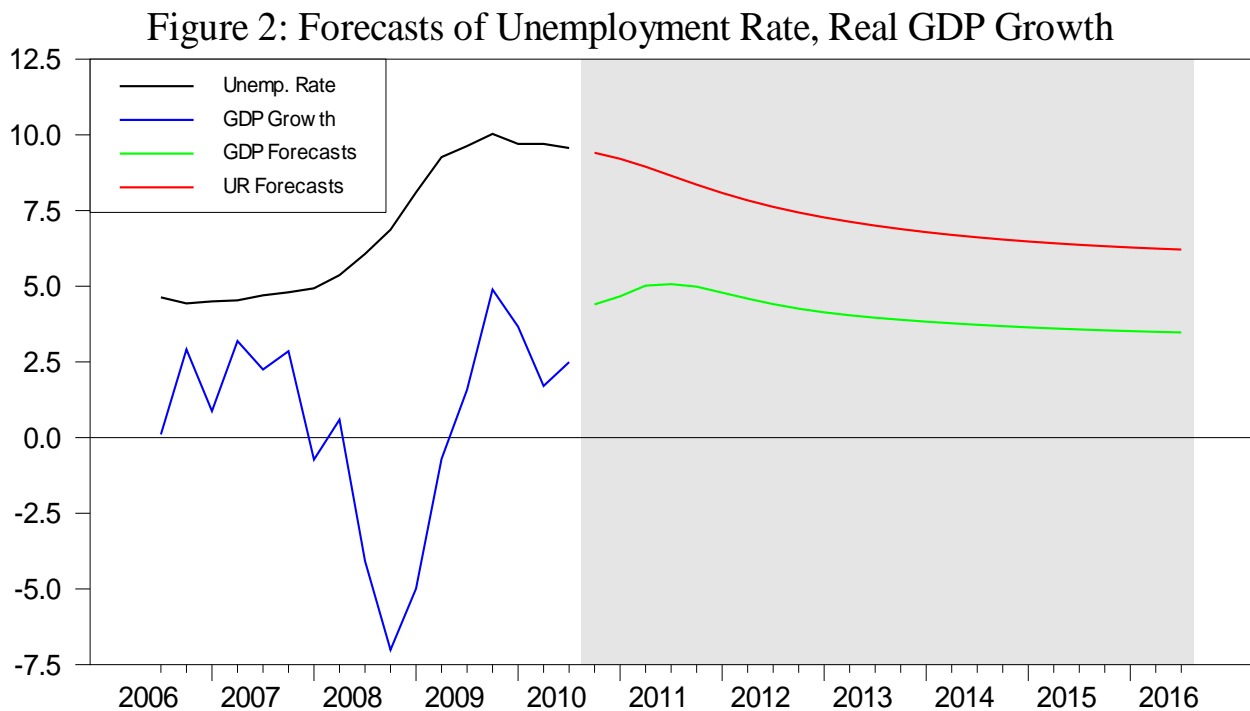
Figure 2 depicts the forecasts graphically. In that figure the actual data beginning in 2006 and ending in the third quarter of 2010 are also included for reference, with the forecasts shown in the shaded area that begins in fourth quarter of 2010. The forecasts smoothly return to more normal levels, with growth converging to a little less than 3.5%, which is near the long-term

average in the post WWII era. Similarly, the unemployment rate slowly approaches 6%, not far from some estimates of the natural rate.

In general, the VAR model performs as expected (perhaps better than expected). Since the model is based purely on past data, it involves no judgment on the forecasts of private or government economists. At the time of this writing the consensus of those forecasts would be for slower real GDP growth, and likely a longer period of high unemployment.

CONCLUSIONS

Much has been written concerning the current (2010) economic climate in the United States. The *great recession* has ended (at least according to most economists), but many worry about a so-called “double-dip,” i.e., another recession following the *great recession* in rapid succession. This paper estimates a simple VAR model based on only two variables of interest, the real growth rate of GDP and the unemployment rate. Here the data and a model based purely on the past behavior of these two series do not support such fears. That model yields forecasts of unemployment and real GDP growth that converge to historical averages. The future path of the variables of interest will undoubtedly be less smooth than that of the forecasts, but these forecasts may serve as reasonable estimates of the future courses of these important economic measures.



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A SURVEY OF DOUBLE DIP RECESSION¹

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ABSTRACT

Since early 2010, many economists were warning the policy makers of occurrence of a double dip recession, yet the authors could not find any solid evidence that it was happening. We noticed that arguments both in favor and against possibility of a double dip recession coexisted and that was why a survey on double dip recession seemed necessary. Based on the data available now at the beginning of 2011 we have not yet found any evidence for occurrence of double dip recession. We have also looked at the state and local data for any sign of double dip recession.

INTRODUCTION

On September 13, 2010, CNBC reported, on its website, that Warren Buffett does not believe in double dip recession. It stated:

Warren Buffett doesn't appear to be concerned that slowing U.S. economic growth will worsen to become a "double-dip" recession, saying there's no evidence of "sour" sentiment in the latest results from Berkshire Hathaway's numerous operating businesses. Speaking today by video to the Montana Economic Development Summit, AP quotes him as telling those attending: "I am a huge bull on this country. We are not going to have a double-dip recession at all. I see our businesses coming back across the board." Bloomberg has almost the same quote, adding the word 'almost' to make it read, "I see our businesses coming back almost across the board." It also adds this quote from Buffett: "I've seen sentiment turn sour in the last three months or so, generally in the media. I don't see that in our businesses. I see we're employing more people than a month ago, two months ago."

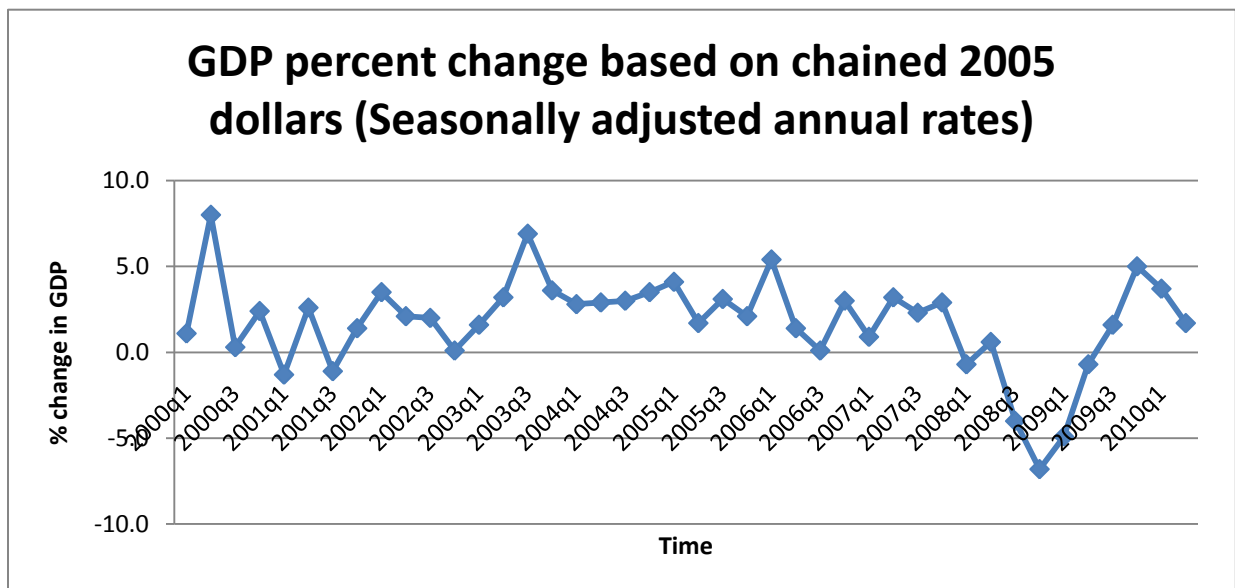
¹ This is a short version of the paper. For the complete version, please contact Reza Kheirandish.

In this paper we will survey the double dip recession and review the debate between those who believe we will face it soon and those who think it will not happen: See [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13] and [14].

GDP Trend

Housing market price bubble started with a rapid growth in prices in the second half of the last decade, was followed by the burst of the bubble and led to the financial market crisis—the major failure of markets in 2008. This, in turn, slowed the growth and eventually set a decreasing GDP trend in the country. By definition, the start of a recession is announced if the GDP has negative growth (goes down) for two consecutive quarters. Based on this definition despite the fact that we experienced a negative growth in the first quarter of 2008 and a slight increase in the second quarter of 2008, we did not officially enter a recession until the fourth quarter of 2008. Also, the same definition implies the official end of recession in the third quarter of 2009.

Graph 1: Real GDP growth rate



One might disagree with this definition of recession. However, to make a comparison with the past recessions one should remain consistent by retaining the same definitions of the phenomena under study.

Unemployment Trend

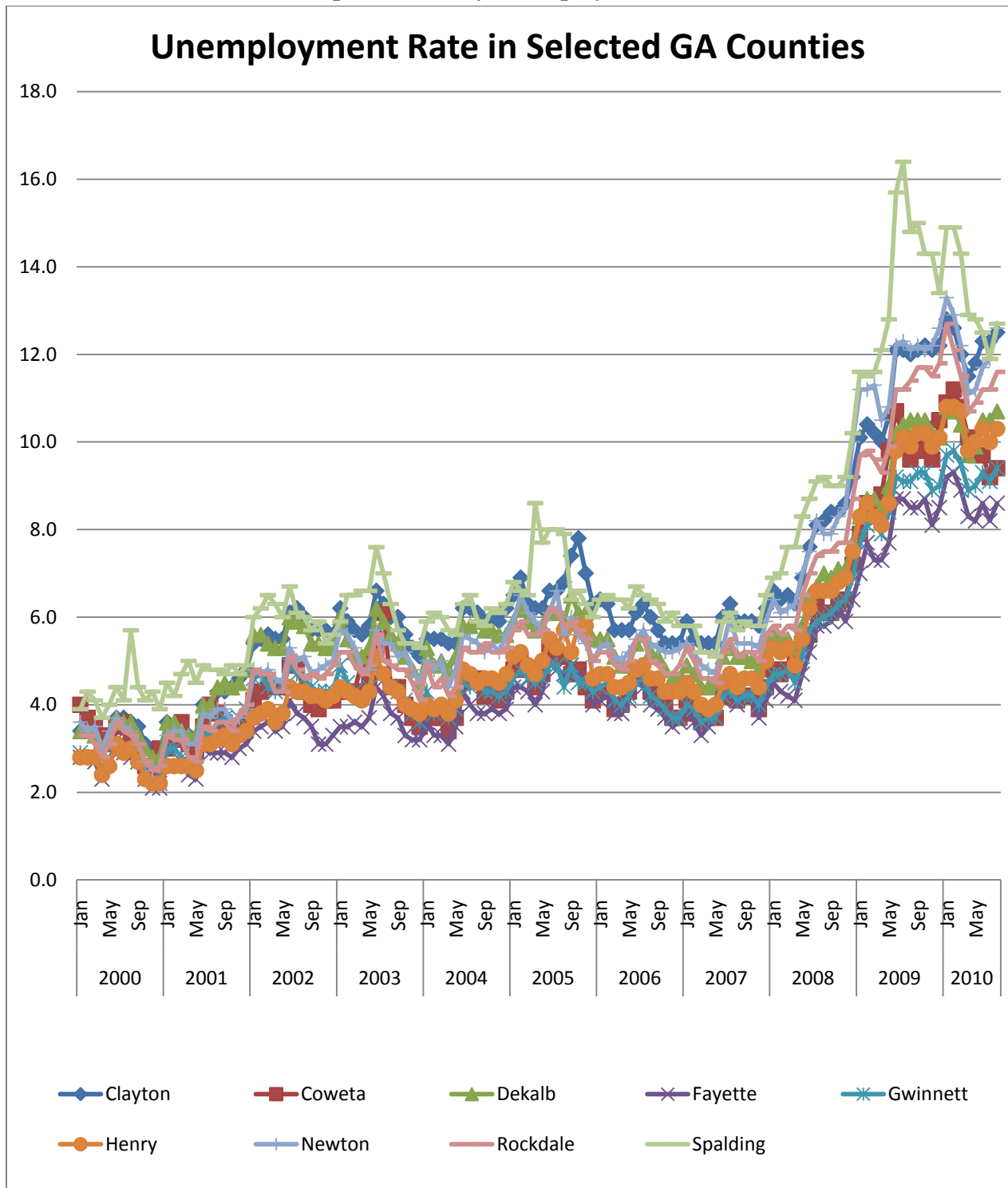
The unemployment rate in US, around 4% in 2000, went up in 2001-2003 following the 2001 short recession. There has always been a lag (delay) in decrease of unemployment rate after a recession. It takes a few quarters to a couple of years, once a positive growth rate is restored, for the unemployment to follow suit. In other words, employers take a while to regain confidence in sustainability of an up-trend economy to start hiring. Even when employers decide to hire, the hiring process can take months to complete, and afterwards it takes one or two more month for the newly changed unemployment rate to be measured and announced by the government. Given the depth of the recent recession and the high increase in the unemployment rate it is only natural to expect a longer recovery—one which may take a couple more years. Given the fact that unemployment has been above 7% for more than 20 months already, it is natural that people are worried about the future of the economy, especially when growth rate is low and unemployment rate is high. As a matter of fact, the growth rate shall be much higher than what we have now to decrease unemployment rate substantially.

Table 1: Monthly and Annual Unemployment Rate (US)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	4.0	4.1	4.0	3.8	4.0	4.0	4.0	4.1	3.9	3.9	3.9	3.9	4.0
2001	4.2	4.2	4.3	4.4	4.3	4.5	4.6	4.9	5.0	5.3	5.5	5.7	4.7
2002	5.7	5.7	5.7	5.9	5.8	5.8	5.8	5.7	5.7	5.7	5.9	6.0	5.8
2003	5.8	5.9	5.9	6.0	6.1	6.3	6.2	6.1	6.1	6.0	5.8	5.7	6.0
2004	5.7	5.6	5.8	5.6	5.6	5.6	5.5	5.4	5.4	5.5	5.4	5.4	5.5
2005	5.3	5.4	5.2	5.2	5.1	5.0	5.0	4.9	5.0	5.0	5.0	4.9	5.1
2006	4.7	4.8	4.7	4.7	4.6	4.6	4.7	4.7	4.5	4.4	4.5	4.4	4.6
2007	4.6	4.5	4.4	4.5	4.4	4.6	4.6	4.6	4.7	4.7	4.7	5.0	4.6
2008	5.0	4.8	5.1	5.0	5.4	5.5	5.8	6.1	6.2	6.6	6.9	7.4	5.8
2009	7.7	8.2	8.6	8.9	9.4	9.5	9.4	9.7	9.8	10.1	10.0	10.0	9.3
2010	9.7	9.7	9.7	9.9	9.7	9.5	9.5	9.6	9.6	9.6	9.8		9.7

While national unemployment rates provide an overall picture of unemployment in the country, one should keep it in mind that different states, cities, and counties, have different unemployment rates. Economic changes affect local unemployment rates differently, for example while oil price crisis hurt most states it helps the state of Texas. Graph 2 depicts how nine counties surrounding Clayton State University are experiencing different unemployment rates patterns, since 2008.

Graph 2: Monthly Unemployment rate



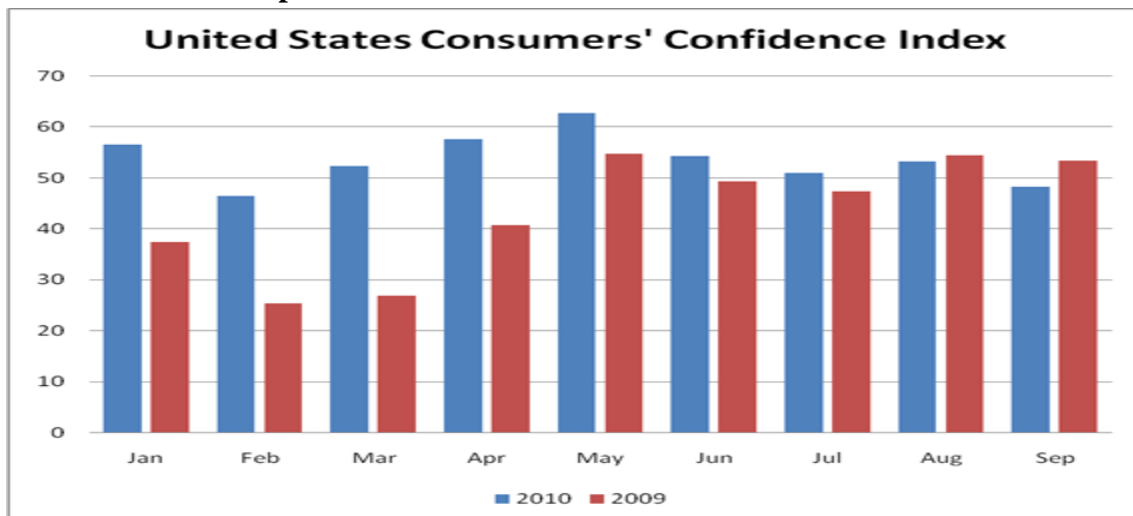
Consumer Confidence Index Trend

Consumer Confidence index for the same month has decreased from 2008 to 2009, whereas, it has increased from 2009 to 2010, with the exception of August and September of 2010 where the Consumer Confidence level was lower than 2009. In September, according to the Conference Board Consumer Confidence index, a measure of the level of optimism, declined to 48.3 from its level of 53.2 in August. Surprisingly, for all the months in 2010 Consumer Confidence index had stayed above its levels in similar months in 2009, demonstrating consumers were regaining their trust in their future and in the economy. It seems the lukewarm economic performance during the summer and the media reaction caused their confidence to drop. After all, the slow economic growth had not been either expected or predicted. Notably, in 2009 a similar trend existed for months of August and September. The Consumer Confidence index declined across these two months. However, it bounced back by November.

Table 2: Monthly Consumer Confidence Index

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	56.5	46.4	52.3	57.7	62.7	54.3	51	53.2	48.3	49.90	54.3	52.5
2009	37.4	25.3	26.9	40.8	54.8	49.3	47.4	54.5	53.4	48.7	50.6	53.6
2008	87.3	76.4	65.9	62.8	58.1	51	51.9	58.5	61.4	38.8	44.7	38.6

Graph 3: 2009 – 2010 Consumer Confidence Index



The greatest fear is that of a double dip recession – a comeback of recession after the start of a slow recovery. So far, as we discussed above, there is no confirmed sign of a double dip recession. Nonetheless, the possibility is being extensively discussed in the media and by economists. If more and more people believe that there is a chance of a double dip recession, that gloomy expectation will lead to more saving (in anticipation of a future economic hardship) and less consumption. Less consumption, in turn, will be followed with less production, leading to a lower GDP that turns pessimistic expectations into reality. The takeaway lesson is that if enough many individuals believe in “false” or “inaccurate” information it can become a reality. Currently, there is no indication that we are facing a double dip recession, but it is possible to face one if more and more people start to think that we are moving in that direction.

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THE RELATIONSHIP BETWEEN THE US-CHINA TRADE BALANCE AND THE VALUE OF THE RENMINBI: AN EMPIRICAL ANALYSIS

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ABSTRACT

The paper is an empirical investigation of the relationship of the exchange rate value of the currency of China vis-à-vis the US dollar and the bilateral trade balance between these two nations. We find several results that are at odds with some published studies of the relationship between the RMB/\$ exchange rate and the trade balance. First, we find that the two series as constructed in this paper do not contain unit roots, which indicates that the two series are not co-integrated. Second, relying on a traditional the vector autoregression model in levels, we find bi-directional *Granger causation* for the two series. Third, the impulse response functions lead us to conclude that an appreciation of the RMB will lead to a decline in China's trade surplus in the long run, with a possible very short-term rise. If the short-term rise is an accurate depiction of the actual response, this is the J-curve effect.

INTRODUCTION

On May 26th, 2010, Tim Geithner, the treasury secretary of United States, visited China to discuss the devaluation of China's currency, the Renminbi (RMB). After this visit, the Chinese governmental Media, the People's daily online, and the Popular Media, Sina.com, argued that China-U.S. relations had entered into a warm spring from a cold winter in less than a year due to the currency rate issue [english.peopledaily.com]. "Geithner respects the Chinese sovereignty on the RMB's issue," [news.sina.com] was reported by the Sina news. However, against this background critiques of China's foreign exchange policy from the Congress and US business groups are commonplace. Additionally, The International Monetary Fund has declared China's currency to be "significantly undervalued," as reported by the NY Times [3]. Many economists agree as the bilateral trade deficit (for the US) has reached unprecedented levels, and much of the "blame" is attributed to the value of the RMB versus the dollar, maintained by the (mostly) fixed exchange rate managed by the Chinese government. There are also skeptics who do not believe that the exchange rate is the main culprit in the bilateral trade imbalance, and some maintain that the deficit may be insensitive to an appreciation of the RMB.

Is there a direct relationship between the US merchandise trade deficit and the RMB? If so, what kind of relationship do the data support? This paper will attempt to test for and quantify such a relationship based on data from traditional sources. We use various statistical techniques to attempt to discover whether such relationships exist and to shed light on the direction of causation.

BRIEF REVIEW OF THE LITERATURE

In the academic field, Zhang [9], using monthly data from 1991 to 1996 for the US-Chinese case, claims strong evidence suggesting that changes in the trade balance and each of its components Granger-cause changes in the exchange rate but no evidence indicating a causal link running from the exchange rate to the trade balance. This result would suggest that changes in the exchange rate would not lead to changed trade balances for China with the US.

Narayan [4] using monthly data from 1979 through 2003, and employing the bounds approach to co-integration finds in favor of co-integration and also finds causal effects of the exchange rate on the real trade balance, measured as the ratio of exports to imports. Groenewold and He [2] use quarterly data from 1987 through 2003. They find in favor of co-integration for a three nation (US, China, and the “rest of the world”) model that includes real GDP values in the analysis. They find modest effects of the exchange rate on the trade balance. Xu [8] uses both annual data and monthly data for the period 1984-2002. Using the Johansen method, Xu finds in favor of co-integration for both the annual and monthly data and effects of the exchange rate on the trade balance in the long-run, but not in the short run. Xu does not use a real exchange rate measure.

CHINA’S FOREIGN EXCHANGE POLICY: A BRIEF REVIEW

The pre-reform exchange system included strict control of foreign exchange transactions and a rigid RMB exchange rate (see [9]). Starting in the early 1970s, China began to list an Effective Rate, which was later pegged to a trade-weighted basket of 15 currencies, for foreign exchange transactions. The former Official Rate since became inoperative.

China created a multiple rate structure in the early 1980s, coinciding with its more open policy, which included a dual exchange rate system: one is for non-trade transactions at a rate of 1.5 yuan per dollar; and another rate is more favorable for the internal settlement of trade transactions. This structure was abolished after 5 years and the Effective Rate then governed all trade.

In 1986, the official exchange rate was pegged to the US dollar. Later, the Effective Rate was placed on a controlled float based developments in the balance of payments and in costs and exchange rates of China's major competitors. China also created a Foreign Exchange Swap Rate.

In the 1990s, began to make more frequent adjustments in the official rate. In April 1993, the real effective exchange rate of the official exchange had depreciated. The Renminbi was firstly allowed to adjust frequently based on the previous indicators. Since 1994, China has been maintaining a “controlled” float foreign exchange regime. The Bank of China (BOC)

implements the foreign exchange plan and is the principal foreign exchange bank of the People's Republic of China. From the second half of 1980s on, authorized banks and institutions can also handle designated foreign exchange transactions with the approval of SAEC [7, 1988-1989, p.425]. In June 2010, China announced it would allow further flexibility in the management of the float, but also emphasized that the bands (for currency fluctuations) would remain the same, but at the same time stated that the basis for widespread appreciation of the RMB does not exist.

RELEVANT THEORIES OF EXCHANGE RATES AND THE BALANCE OF TRADE

In this section we discuss two approaches to exchange rates and the balance of payments that are relevant to the US-China bilateral trade balance and the value of the Renminbi. There are other approaches that may be considered; these are chosen for their relevance to the matter considered in this paper.

The Elasticities Approach

The depreciation of a home currency raises the prices of imported goods in the home currency and lowers the prices of exported goods in the foreign currency. As quantities demanded respond to the price changes, import quantities will fall and export quantities will rise. On the import side, if the percentage change in quantity is smaller than the percentage change in price (meaning the demand for imports is relatively inelastic), the value of imports measured in the home currency will rise. Such a rise in the value of imports could cause the balance of trade to deteriorate in the short-run. The result depends on the elasticities of import and export demand. The famous Marshall-Lerner condition proves that if the sum of the elasticities of import and export demand exceeds 1, a depreciation of the home currency improves the trade balance. In the long run, price elasticities are greater and therefore their sum is likely to exceed 1. Given the preceding, after depreciation the trade balance may worsen in the short-run, before improving in the longer run. This scenario is called the J-curve effect. The upshot of the elasticities approach is that economists generally agree that depreciation of an overvalued currency will reduce a trade deficit, and appreciation of an undervalued currency will very likely reduce a trade surplus. If the RMB is indeed undervalued, an appreciation vis-à-vis the dollar should serve, *ceteris paribus*, to reduce China's bilateral surplus with the US.

Bernanke's Savings Glut Hypothesis

The existence of a bilateral surplus or deficit may have causes other than the foreign exchange value of the currency.

Bernanke interprets the US current account deficit with two perspectives, one is trade flows and related payments and other is investment and national saving. Bernanke argues that "a global saving glut—which helps to explain both the increase in the U.S. current account deficit and the relatively low level of long-term real interest rates in the world," is the most important recent factor determining the US international position. If savings in the rest of the world exceeds investment, with the reverse occurring in the US, those excess foreign savings are invested in US financial assets. The accounting identity that links the current account and the capital account

(now called the financial account) means that as foreign purchases of US financial assets exceed US purchases of foreign financial assets (financial account surplus), the US must run a current account deficit.

This explanation of the current account deficit does not contradict the contention, based on the Marshall-Lerner condition, that depreciation will improve a trade deficit, but it does indicate that the *cause* of such a deficit may not be a misaligned currency. Further, if the savings glut hypothesis is correct, a movement to a freer system of exchange rate determination on the part of China is no guarantee of an appreciation of the value of the RMB versus the dollar.

DATA

The data set for this research consists of the following:

M_{US}	=	US merchandise imports from China, not seasonally adjusted
X_{US}	=	US merchandise exports to China, not seasonally adjusted
CPI_{US}	=	the Consumer Price Index for the US
CPI_C	=	the Consumer Price Index for China
RMB	=	the spot rate of exchange between the Renminbi and the dollar, stated in Yuan per Dollar

All data are monthly, beginning in January 1987 and ending in February 2010. (The start date is constrained by the reporting of CPI inflation for China.) The import and export series are from the Census Bureau of the United States. The remaining three series were collected from the International Financial Statistics (IFS) database from the International Monetary Fund.

GRAPHICAL ANALYSIS

Figure 1 shows US imports from and exports to China. The figure shows clearly the increasing bilateral trade surplus for China (deficit for the US) over the 1987-2010 period.

The seasonality of the series is also evident, as is the slowdown in US imports from China, likely associated with the great recession, at the end of the series.

Figure 2 is the nominal exchange rate between the Renminbi and the Dollar, clearly showing relatively long periods over which the exchange rate was fixed. Also note the significant depreciation (devaluation) of the RMB from 1987 through 1994, followed some appreciation since 1994.

Figure 3 shows the behavior of the respective price indexes and the spot rate for the RMB, all series normalized to zero. For example, the CPI for the US is transformed as follows: $P_{US} = 100 \cdot \ln(CPI_t / CPI_0)$, where the subscript t refers to the current period, and the subscript 0 , refers to the initial period, January 1987.

Figure 1: Graph US Imports and Exports with China

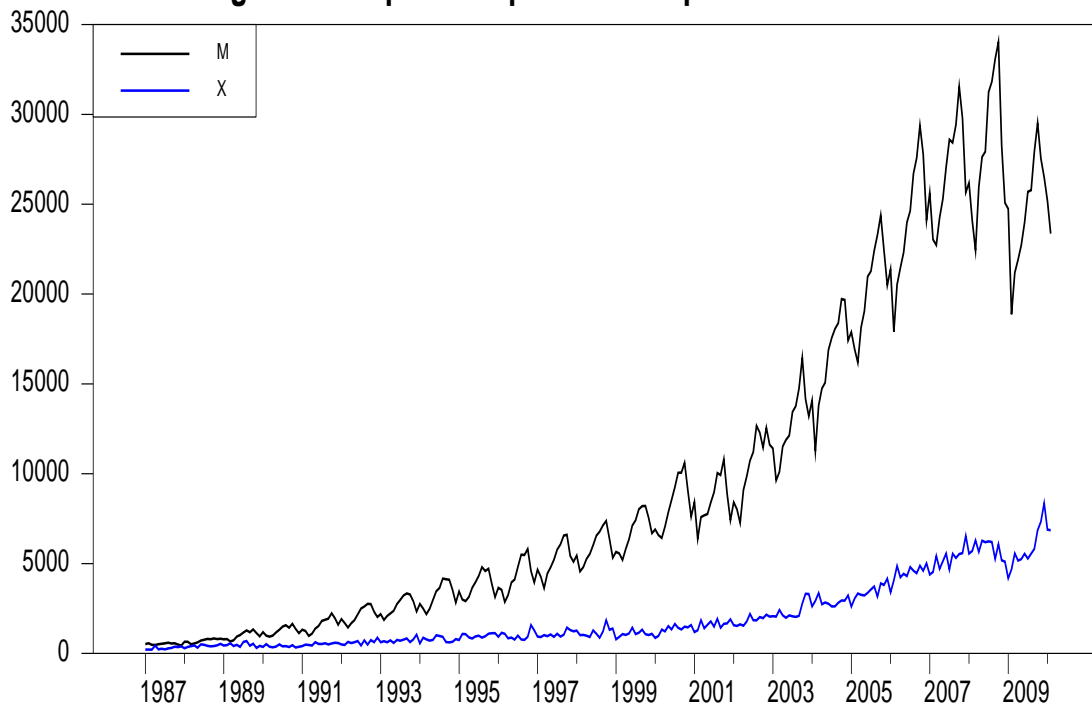


Figure 2: Nominal RMB per Dollar

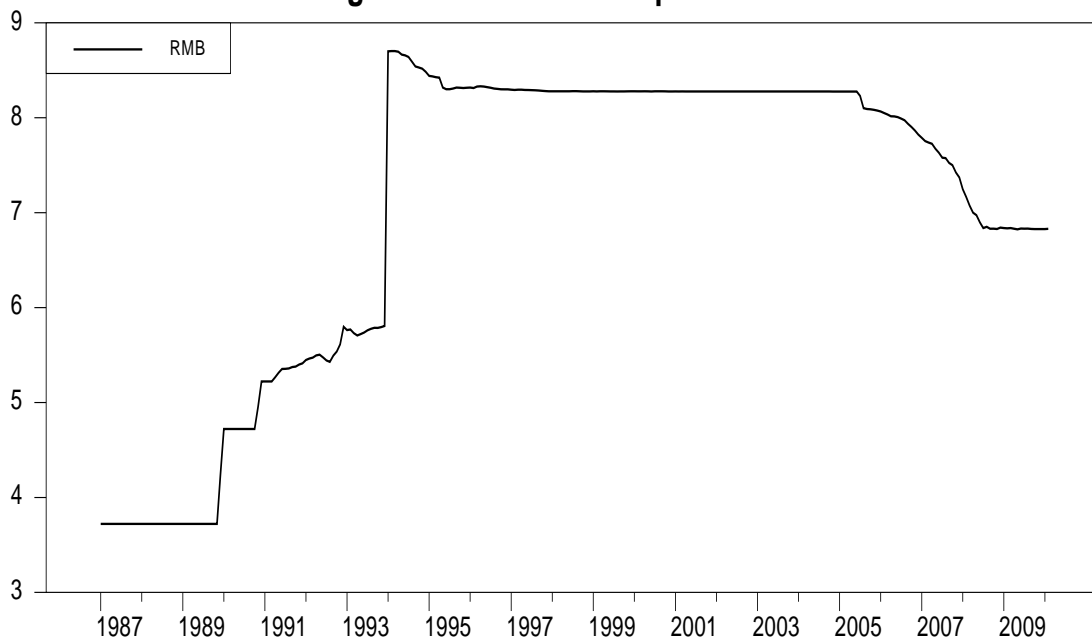
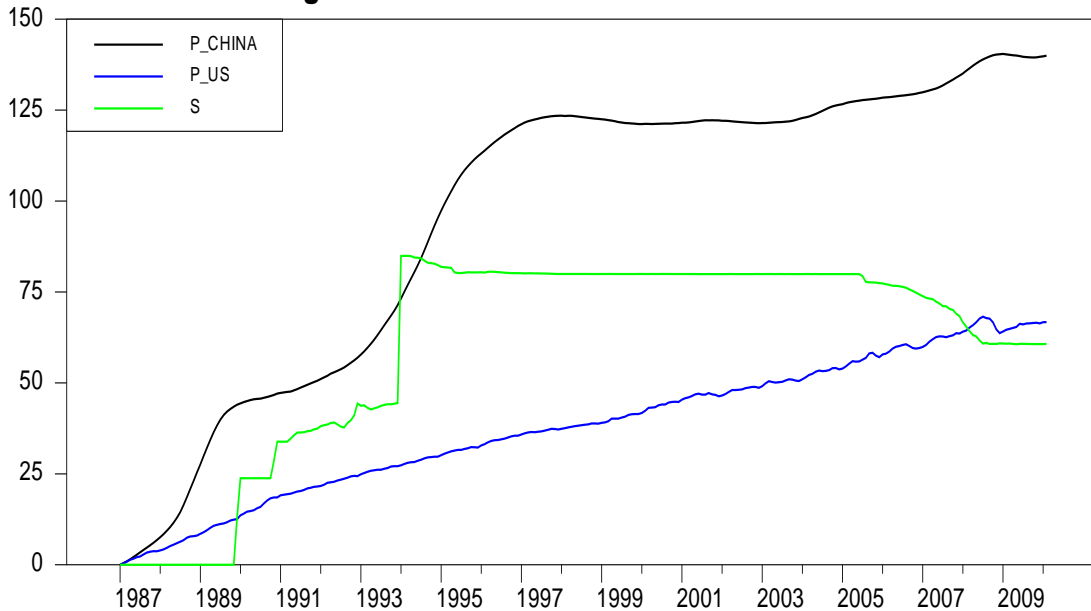


Figure 3: CPIs and RMB Normalized to 0



From these series in Figure 3, it is a simple exercise to compute the real value of the RMB. These calculations are based on the idea of (relative) purchasing power parity (PPP) which accounts for differential rates of inflation among nations. Generally, if absolute PPP were to hold, the following equation would also hold:

$$s = \frac{P_c}{P_{US}}, \quad (1)$$

Where s = spot rate of exchange (here Yuan per Dollar), P_c = the price level in China, P_{us} = price level in the US. Taking logs:

$$\ln(s) = \ln(P_c) - \ln(P_{US}). \quad (2)$$

If PPP were to hold (and held at the start of all three series), then in Figure 3, the spot rate would approximately “split the difference” between the two price level series.

Changes in the time-series of (2) represent the percentage changes in the variables. The real exchange value of the currency can then be defined as:

$$\ln(real) = \ln(P_c) - \ln(P_{US}) - \ln(s) \quad (3)$$

For example, suppose that China has 6% inflation, while the US has 4% inflation. If the RMB price of the dollar rises by 2%, relative PPP is maintained. However, if the same inflation rates pertain, and the spot rate remains fixed, the real PPP value of the RMB will have risen by 2%. It is important to note that, computed in this way (which is consistent with the current literature on

PPP), the rise in the real value of the RMB represents an appreciation of the currency, and a fall in the real value is a depreciation.

Figure 4: Real Renminbi

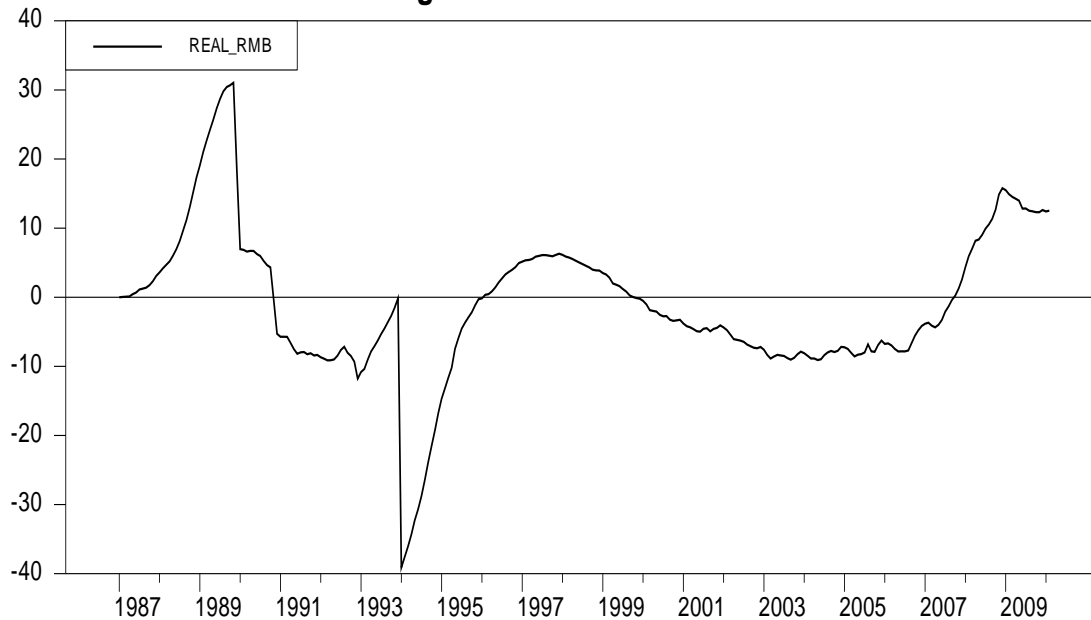


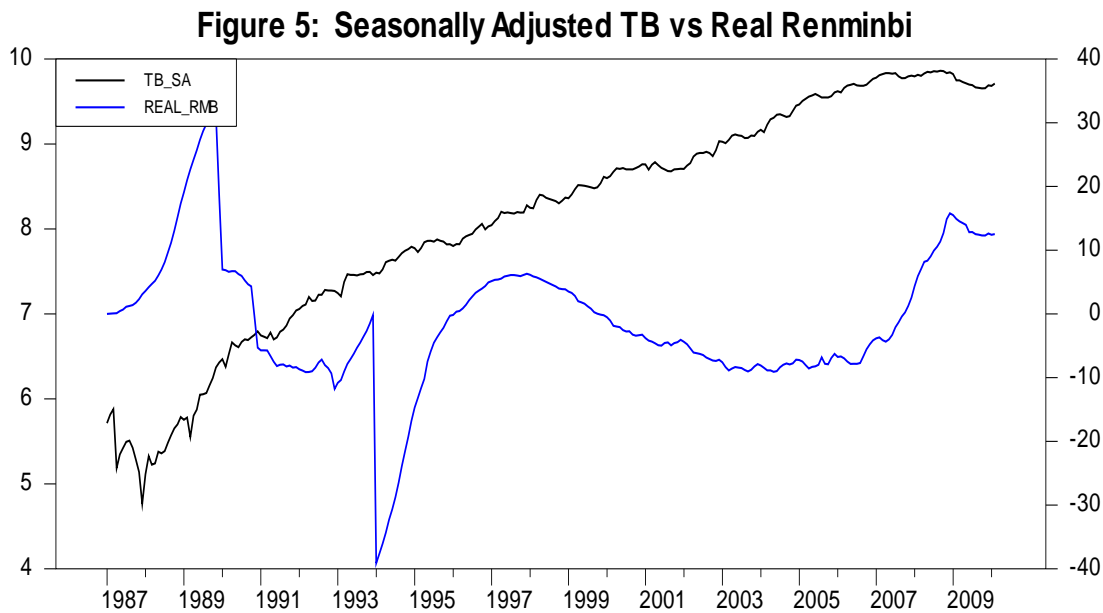
Figure 4 represents the real value of the RMB as computed by equation 3 above. The sharp depreciation of the RMB in 1994 is evident, followed by a rapid appreciation through 1997. After 1997, the real value of the RMB declined mildly until 2004, appreciating thereafter until 2009. Thus the combination of differential inflation rates and changes in the spot rate produces a real rate of exchange with significant variation.

In order to analyze China’s surplus (US deficit) in bilateral trade, we make the following computations. First we define the trade balance (TB) as:

$$TB = M_{US} - X_{US}, \text{ so that the measure represents China's surplus.}$$

Next, since the original data are not seasonally adjusted, we seasonally adjusted the TB by a seasonal exponential smoothing technique (see the procedure “esmooth” in RATS from Estima), the resultant series is called TB_SA.

The real Renminbi and the seasonally adjusted Trade Balance are graphed together in Figure 5. The left-hand scale is the real RMB and the right-hand side scale is the natural log of the seasonally adjusted Trade balance. It is difficult to discern visually any relationship between the series. Both series have trends (and possibly breaks) which can obscure (or falsely indicate) relationships. Further, economic theory suggests that the effects of one series on the other are not likely to be contemporaneous.



Then for conclusions with regard to the trade balance and the value of the RMB, we will rely on the statistical analysis that follows.

STATISTICAL ANALYSIS

In this section we present evidence on tests of the relationship between the RMB/Dollar rate and the bilateral trade balance by four methods. First, we estimate a VAR (vector autoregression) in levels. Secondly, we estimate a VAR in differences, third we test for co-integration of the two series, and finally we estimate a simple distributed lag model.

VAR in Levels

A vector autoregression (VAR) for this project can be represented as follows:

$$real_rmb_t = \delta + \sum_{i=1}^p \beta_i (real_rmb)_{t-i} + \sum_{i=1}^p \alpha_i (tb_sa)_{t-i} + \mu_t, \quad (4)$$

where p is the order of the VAR. Each variable also serves as the left-hand side of 4. The lag length is commonly chosen via complexity penalized model selection criteria, such as the AIC (Akiake Information Criterion) and the SIC (Schwarz Information Criterion). When the AIC and the SIC differ on the appropriate model, the AIC tends to choose the less parsimonious model. Since we are interested in effects of exchange rates which may take many months to complete, we choose longer lag lengths. In the current research, a version of the AIC that does not correct for degrees of freedom, selects very long lag lengths (more than 60 months) and the version that does such corrections, selects only 1 lag. We experimented with lags of three and four years in approximate accord with economic theory that suggests that the effects of currency depreciation

or appreciation are felt over a relatively long period, and to allow for lagged effects over a period that allows for possible J-curve effects. We report results with three years plus one month to account for potential seasonal effects (the authors of the RATS manual recommend at least one year of lags plus one additional season, in part because some seasonal adjustments over adjust the data).

Table I: VAR in levels, Dependent Variable: TB_SA (p = 37)

F-Tests		
Variable	F-Statistic	Significance
TB_SA	5123.2267	0.0000000
REAL_RMB	1.4882	0.0484488

Table II: VAR in levels, Dependent Variable: Real_RMB (p = 37)

F-Tests		
Variable	F-Statistic	Significance
TB_SA	1.7308	0.0106513
REAL_RMB	54.0072	0.0000000

Tables I and II contain the results of the tests for Granger causality. The results indicate that each variable Granger causes the other at least for p-values less than .05. That is, the dynamics of the VAR model results suggest bidirectional causation between the trade balance and the value of the RMB.

Figure 6: Impulse Responses: TB and Real RMB in Levels

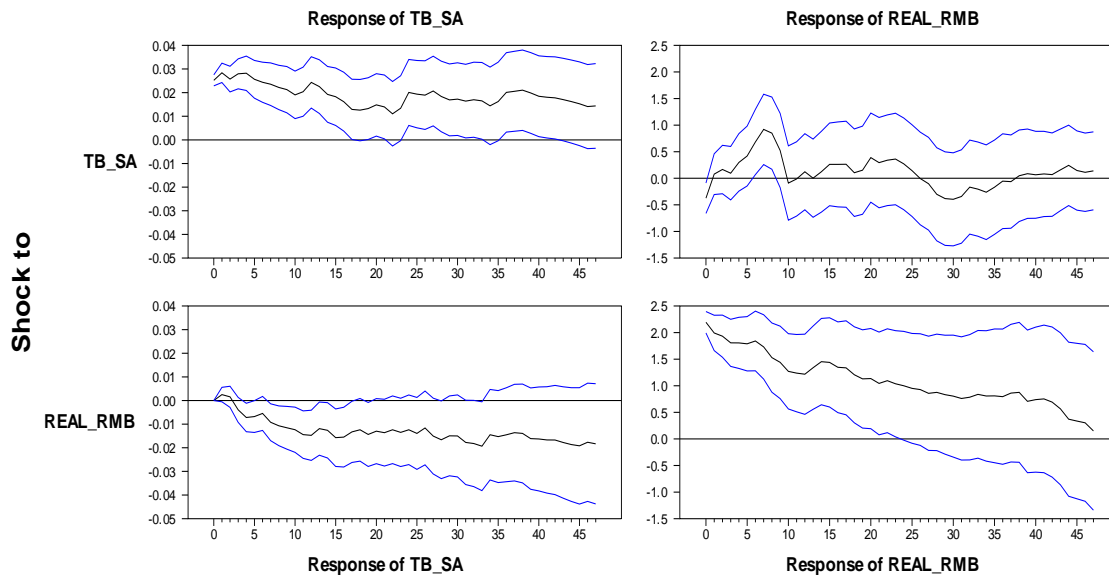


Figure 6 contains the impulse response functions to one-standard error of the estimate of the equation shocks to each of the series along with 95% error bands. Most interesting is the graph in the lower left-hand corner of the figure. The impulse response suggests that rise in the real value of the RMB has, at first, a positive effect on the trade balance (the trade balance widens)

that lasts only 2 or 3 months, followed by a persistent fall in the trade balance lasting several years. In other words, the impulse response function (should we choose to believe it) lends some support to the J-curve hypothesis. Though we find this result interesting, we do not wish to put too much faith in the result. Note that the error bands often cross the zero lines, and this result is not supported by VARs with small lag lengths.

Note further that the upper right-hand graph suggests little effect on the real RMB from a shock to the trade balance, perhaps a short-term appreciation, with the longer term effect approximately zero.

VAR in Differences

Some authors recommend against differencing in VARs even if the variables contain a unit root (see for example [6]), arguing that differencing throws information away with no gain in asymptotic efficiency. Others disagree, arguing that variables should be modeled in accord to their proper data generating process (DGP). Given that the debate is unsettled, we choose to report results for the VAR in differences. (The section that follows suggests that these series need not be differenced.)

Tables III and IV gives the Granger causality tests for the VAR in differences. Table III suggests that changes in the trade balances are related to its “own” lags and weakly related to lags in the real value of the RMB. Table IV indicates that changes in the real value of the RMB are not related to its own lags, but are related to changes in the trade balance. That is, changes in the trade balance *Granger cause* changes in the real RMB.

Table III: VAR in differences, Dependent Variable: ΔTB_SA ($p = 36$)

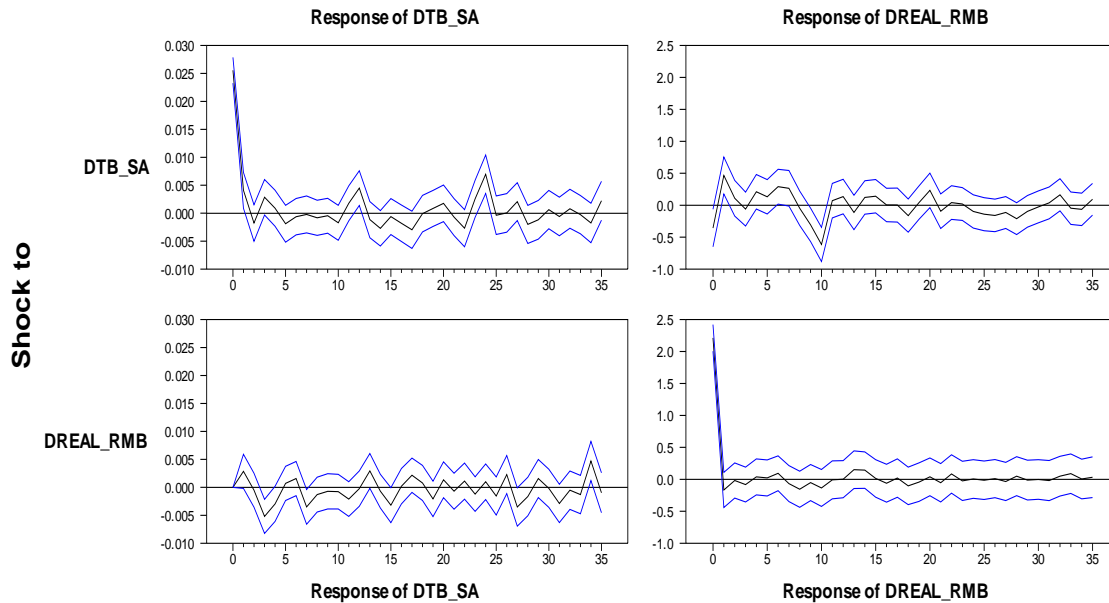
F-Tests		
Variable	F-Statistic	Significance
ΔTB_SA	2.7354	0.0000079
$\Delta REAL_RMB$	1.4679	0.0559571

Table IV: VAR in differences, Dependent Variable: $\Delta Real_RMB$ ($p = 36$)

F-Tests		
Variable	F-Statistic	Significance
ΔTB_SA	2.7354	0.0000079
$\Delta REAL_RMB$	0.2810	0.9999852

The impulse response functions in Figure 7 indicate little effect on the “other” series, and almost no effects past the initial shock on the “own” series.

Figure 7: Impulse Responses: Trade Balance and Real RMB in Differences



Cointegration Analysis: The Engle-Granger method

We employ the Engle-Granger method to test for long-term common trends. The method is called co-integration analysis. In general, the series believed to be co-integrated are tested for the order of integration—that is a test for unit roots. The augmented Dickey-Fuller test for a series y_t is implemented by a regression of the form:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^n \Delta y_{t-i} + e_t \quad (5)$$

The null hypothesis of a unit root (non-stationarity) is a t-test of $\alpha_1 = 0$. If the null is not rejected, the series is differenced and re-tested for a second root. The number of lags (n) is chosen by the Akaike Information Criterion (AIC).

Assuming the order of integration is the same for the series under consideration, co-integration analysis proceeds to estimate the long run equilibrium relationship (co-integrating vector) between y and z as follows:

$$y_t = \beta_0 + \beta_1 z_t + \varepsilon_t \quad (6)$$

If the series are co-integrated, the residuals from (2) must not contain a unit root.

Assuming the series are co-integrated, the error-correction model is estimated:

$$\Delta y_t = \alpha_1 + \alpha_y (y_{t-1} - \beta_1 z_{t-1}) + \sum_{i=1}^n \alpha_{11}(i) \Delta y_{t-i} + \sum_{i=1}^n \alpha_{12} \Delta z_{t-i} + \varepsilon_{yt} \quad (7)$$

$$\Delta z_t = \alpha_2 + \alpha_z (y_{t-1} - \beta_1 z_{t-1}) + \sum_{i=1}^n \alpha_{21}(i) \Delta y_{t-i} + \sum_{i=1}^n \alpha_{22} \Delta z_{t-i} + \varepsilon_{zt} \quad (8)$$

The error correction forms are examined for statistical significance of the terms α_y , α_z . If for example, α_y is not different from zero, then deviations from the long term relationship in period $t-1$ do not affect y_t . Similarly, if α_z is not different from zero, then deviations from the long term relationship in period $t-1$ do not affect z_t .

Tests for unit roots

We follow the methodology suggested by Enders [1, p. 213] to test the two series for unit roots. We start with the least restrictive model (which includes a time trend and drift) for each series. The test for the real trade balance is an interesting application of such tests. We augment (5) with the trend term and constant (drift). We describe the results in the remainder of this paragraph. First, the ADF t-test is -2.59 , meaning that the null of a unit root cannot be rejected for this formulation (ADF critical value is -3.13 at the 10% alpha level). Second, given that $\alpha_I = 0$, we test to see if the trend coefficient is zero. It is not (that null is rejected at alpha $< .01$). Now since the trend is present in the real trade balance as we have defined it, we retest for $\alpha_I = 0$, using the standard normal distribution (with a trend present, the limiting distribution for α_I is standard normal). Given the value of -2.59 , we can reject the null of a unit root at the alpha 1% level. The conclusion is that the real trade balance variable does not contain a unit root. We also tested this series with drift only, and we reject the null of a unit root.

For the real RMB series, the trend and drift are not statistically significant in the ADF context, so we test for the null of a unit root ($\alpha_I = 0$), with the simple version of (5). The ADF t-test is -2.2322 . The ADF critical value at alpha 5% is -1.95 , so the null of a unit root can be rejected.

The conclusions drawn are that neither series contains a unit root; hence, traditional time series methods may be applied, which we interpret as an argument for greater confidence in the results of VAR in levels from above.

The equilibrium regression

Despite the results of the unit roots tests, we experimented with the co-integration formulation. One result that may be of interest to other researchers is that the “equilibrium regression,” a simple regression of either the real RMB on the Trade balance or the reverse, yields an R^2 of only 0.025, an incredibly low value for a time-series regression.

A Distributed Lag Experiment

As a final experiment, we modeled the trade balance as a deterministic trend, adding lags of the Real RMB. This experiment will test to see if deviations from the trend can be explained in part by the real exchange rate. First we entertain long unrestricted lags as advocated by Sims [6], and

then we also allowed the AIC to choose the number of lags. We choose 36 lags for the unrestricted experiment and 10 lags are chosen by the AIC. Because of the multicollinearity among the lagged values of the real RMB, the individual lag coefficient estimates are not reliable. It is common, therefore, to report the sum of the lagged coefficients and the corresponding t-statistics. Table V contains the results of these experiments.

Table V: Distributed lag diagnostics, Dependent Variable = Trade Balance

<i>Real RMB lags = p</i>	$\sum p_i$	<i>t-statistic</i>	<i>Significance</i>
<i>p = 36</i>	-0.0138	- 10.13	0.0000
<i>p = 10</i>	-0.0149	-8.98	0.0000

The lag sums have the anticipated signs, indicating that deviations from the trend are partially explained the real value of the currency in the anticipated direction. The t-tests indicate such effects are highly significant statistically.

RECONCILING THE CURRENT RESULTS WITH PRIOR RESEARCH

Our results conflict with some of the prior research on the same topic, and the earlier research is itself unsettled. As noted in the review of the literature, Zhang [9] find co-integration of China's overall trade balance and the exchange rate, but the data in that work are monthly observations for a very short period—only from 1991 to 1996. Additionally, he finds no causal effect of the exchange rate on the trade balance. Narayan [4] also finds in favor of co-integration and finds causal effects of the exchange rate on the real trade balance, measured as the ratio of exports to imports. Narayan employs a somewhat unusual approach to co-integration (the bounds approach) and the data are monthly for a longer period of time, 1979-2003. Groenewold and He [2] use still different data, quarterly observations from 1987 through 2003, and they employ three series. They find in favor of co-integration for a three nation (US, China, Rest-of-the-World) model using including real GDP values in the analysis, and they find modest effects of the exchange rate on the trade balance. Using the Johansen method, Xu [8] finds in favor of co-integration for both the annual and monthly data with effects of the exchange rate on the trade balance in the long-run, but not in the short run. Xu, however, does not use a real exchange rate measure as do the earlier papers. In summary, most of the published work finds that some measure of the exchange rate is co-integrated with some measure of the trade balance, but the research results are ambiguous on the question of whether or not causation runs from the exchange rate to the trade balance.

We employ the Engle-Grange approach to co-integration using monthly data from 1987 through 2010. We do not find in favor of co-integration as explained above. We in fact reject the null hypothesis of unit roots for each of the two series. We do find bi-directional Granger causality between the trade balance and the real exchange rate in a VAR in levels, and we find evidence of causation running from the exchange rate to the trade balance in a distributed lag formulation.

The diversity of conclusions may not be as surprising as it seems at first reading since it is clear that the authors employ different measures of the variables, over differing periods, and utilize different statistical methods.

CONCLUSIONS

We find several results that are at odds with some published studies of the relationship between the RMB/\$ exchange rate and the trade balance. First, we find that the two series as constructed in this paper do not contain unit roots, which indicates that the two series are not co-integrated. Such a finding does not, of course, mean that the two series are unrelated. It does indicate that traditional time series methods are appropriate for analysis of the series. Second, relying on the VAR model in levels, we find bi-directional *Granger causation* for the two series. Third, the impulse response functions lead us to conclude that an appreciation of the RMB will lead to a decline in China's trade surplus in the long run, with a possible very short-term rise. If the short-term rise is true, this is the J-curve effect.

Economic theory, the results of this research, and the consensus of prior empirical work strongly indicate that appreciation of the RMB will lead, *ceteris paribus*, to a reduced trade surplus with the United States. The actual surplus is also likely to be affected importantly by economic forces not considered in the current research, such as real GDP, governmental trade policy, and differential savings rates.

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A Transportation Alliance of Environmental Horticulture Producers in Georgia: An Aid to Buying and Selling Local

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Abstract

The costs of transporting plant material to market and of the acquisition of production inputs are of concern to environmental horticulture crops producers. Transportation costs rose 21-percent in 2009, and now account for 10-percent of the total cost of plant production. The primary objective of this study is to determine if transportation alliances would reduce shipping costs, increase distribution efficiencies, and reduce CO₂ emissions (reduce the carbon footprint) among floriculture and ornamental plants producers in Georgia. Using data from a survey of small- and medium-sized nurseries and greenhouses in Georgia, plus the GIS software, ArcLogistics 9.3, routing systems were developed for the alliance and participating nurseries, so that sensitivity analysis could be conducted to show cost savings opportunities through a transportation alliance. The results indicated an average total cost savings to producers of 9-percent, an average total miles driven savings of 8-percent, an average number of trucks savings of 8-percent, an average hours driving savings of 15-percent, and an average CO₂ savings of 8-percent.

Background

Throughout the last five years, economic and social and climatic factors have negatively impacted the ornamental and nursery crops (environmental horticulture) industry in Georgia. A prolonged drought, the global and domestic economic recession, the instability of oil prices and availability, and the increases in production inputs costs have forced this industry to become more efficient and productive. Nearly forty percent of the industry capacity (production and marketing) in Georgia has been lost due to the aforementioned factors.

Costs have risen dramatically and the market has become more complex and dynamic. This trend has been more persistent in terms of one specific activity: transportation and logistics. Transportation is becoming the determining factor of success of most ornamental operations, regardless of size. How, when and with whom growers do their shipping determines how sustainable, efficient, productive, and profitable an operation becomes.

Ornamental and nursery crops operations are realizing the importance of operating a cost efficient logistic operation that minimizes the cost of miles driven, fleet or vehicle ownership costs, and labor costs. Many ornamental crops production operations, however, do not have the resources to determine how much right-sizing is necessary or appropriate for them. Most Georgia operations own their own box trucks and tow-trailers, owning multiple units of various sizes and capacities so that a match can occur between order size and appropriate vehicle for delivery. A few large

operations use contractual agreements with truck-and-driver leasing firms, although most of these production operations own (or previously owned) their own trailers. "The remedy for the medium- and small-sized carrier businesses is to establish coalitions in order to extend their resource portfolio and reinforce their market position," (Krajewska and Kopfer, 2006).

Georgia's Situation

Georgia's green industry, which includes greenhouse/floriculture production, container nursery production, field-grown production, and sod/turf production, is among the top three agricultural industries in Georgia, and Georgia is the tenth largest plants producer in the nation contributing \$5 billion in revenue while providing 62,000 jobs (Hall et al, 2006). The largest source of seedlings, whips, grafts and liners for the ornamental crops industry is Georgia itself, with the other leading suppliers being Florida, Oregon, Tennessee and Alabama, respectively (Brooker et al, 2005). Approximately 94-percent of Georgia total annual sales are to wholesale, with the remaining 6-percent to retail (mass merchandisers, home improvement centers, garden centers, landscape firms, and re-wholesalers). Ironically, on several occasions deliveries are being made from the same source to neighboring operations and/or growers are making deliveries to common buyers at about the same time, duplicating the transportation costs for the shippers.

Although fractional gains were observed in the production value of ornamental or container grown horticulture over the past few years, these gains were offset by declines in turfgrass, field-nursery, and greenhouse production in Georgia. The increase of energy and fuel prices, the economic recession, double-digit unemployment, the housing slump, the credit crunch, the weakening of the US dollar, and reduction in personal income are all factors reducing the consumption of discretionary goods, such as environmental horticulture. These trends keep businesses focused and concerned on the viability and sustainability of their businesses, and forces operators to be more competitive.

Transportation Issues

The demand for freight transportation is increasing in the US, which is an astonishing fact given that the US already accounts for a third of the transportation fuel used worldwide, and that the US imports more than half of the petroleum it consumes (Beaubouef, 2008). Among the factors that affect the expansion of environmental horticulture nurseries, production, marketing, personnel, and transportation are considered the most relevant (Hodges and Haydu, 2005). Nurseries ranked transportation as an important factor of concern for expansion of markets, ranking transportation above debt capital, equity capital, and marketing, but below personnel and production (Brooker et al, 2005). In the agricultural sector, the importance of transportation costs is heightened as evidenced by the fact that transportation accounts

for over ten percent of the wholesale value of total farm shipments (Stegelin, 2009). Logistic cooperation is an important strategic alternative to reduce costs and increase efficiency in the agricultural sector. As previously mentioned, Georgia's ornamental industry participants share clients, routes, and origins; however, each producer has an independent transportation system.

Research Problem and Methodology

The main objective of this research is to determine if a transportation alliance through horizontal cooperation and routing junctions would reduce shipping costs and increase distribution efficiency among environmental horticulture producers in Georgia. The methodology includes conducting surveys of medium to small nurseries and greenhouses in Georgia to gather data regarding shipping costs, orders, delivery instructions, timing, and fleet management; constructing routing and cost analysis for each participant nursery and the proposed transportation alliance, and determine with sensitivity analysis if the alliance would help reduce costs and increase distribution efficiency; and developing a route plan(s) for the aforementioned alliance and participant nurseries to evaluate the applicability of the GIS software ArcLogistics 9.3 in the ornamental industry.

The research problem necessitates identifying strategic alliance objectives and dimensions in logistic management, horizontal logistic cooperation components and opportunities, benefits of joint route planning in transportation; the use of information technology and the application of the GIS software, and the collection of data from nurseries. The procedural steps for conducting the research were to (1) develop a survey instrument for questioning the small- and medium-sized nursery and greenhouse operators as to their costs and practices with respect to transportation and logistics; (2) conduct the survey; (3) utilize a simple unit cost allocation model that was adaptable and useable with the GIS software ArcLogistics 9.3; and (4) evaluate and interpret the results to build a sensitivity analysis.

Once the order sharing routings were developed, three alliances were considered – a north, a south, and a central location cluster – which represented most of the production among small- to medium-sized operations. An attempt was made to determine the optimal number of orders per shipping cycle, given the three location clusters (alliances), with the decision to assign 50, 100, and 150 orders per shipping cycle due to the variability and inconsistency in current deliveries. Time windows were also evaluated with respect to the delivery efficiency (time spent unloading at each delivery destination), which were also grouped as 30-, 60-, and 90-minute stops. With respect to each of the alliances, a central depot location (central to the producing operations in that alliance) and a major thoroughfare location were also evaluated. Figures representing many of these actions are presented following the selected reference citations.

Although the study seemed to have buy-in from the growers, issues or concerns among the cooperators and participating nurseries arose with respect to the survey: “What’s in it for me?”; a reluctance to provide logistics, marketing and plant sales information; the question of what is an alliance (“Please tell me it is not a camouflaged term for a ‘cooperative’?”); survey design; adequate sample size; format and availability of data needed to run the software; a lack of commonalities among the growers (facilities, vehicles, customers and their locations, flower or plant size/shape/form, shipping containers or carts, delivery dates and times, driver efficiency, etc.); and the managerial relevance of using averages in conducting the sensitivity analysis.

Results

The majority of participants responded that transportation is a key limiting factor for the growth of their respective businesses. Eighty-percent of the respondents stated that transportation costs did increase in the past year (2009) at an average rate of 21-percent over year-earlier data, and that transportation now accounts for over ten-percent of their total cost of production and marketing.

The net results from having evaluated the plausibility and feasibility of utilizing transportation alliances among Georgia’s small- and medium-sized environmental horticulture crops producers were:

- Average total cost savings to the participating operators were nine-percent;
- Average total miles driven savings were eight-percent;
- Average number of trucks owned savings were 8-percent;
- Average hours driving time savings were fifteen-percent; and
- Average CO₂ savings (reduced carbon footprint) were eight-percent.

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Figures

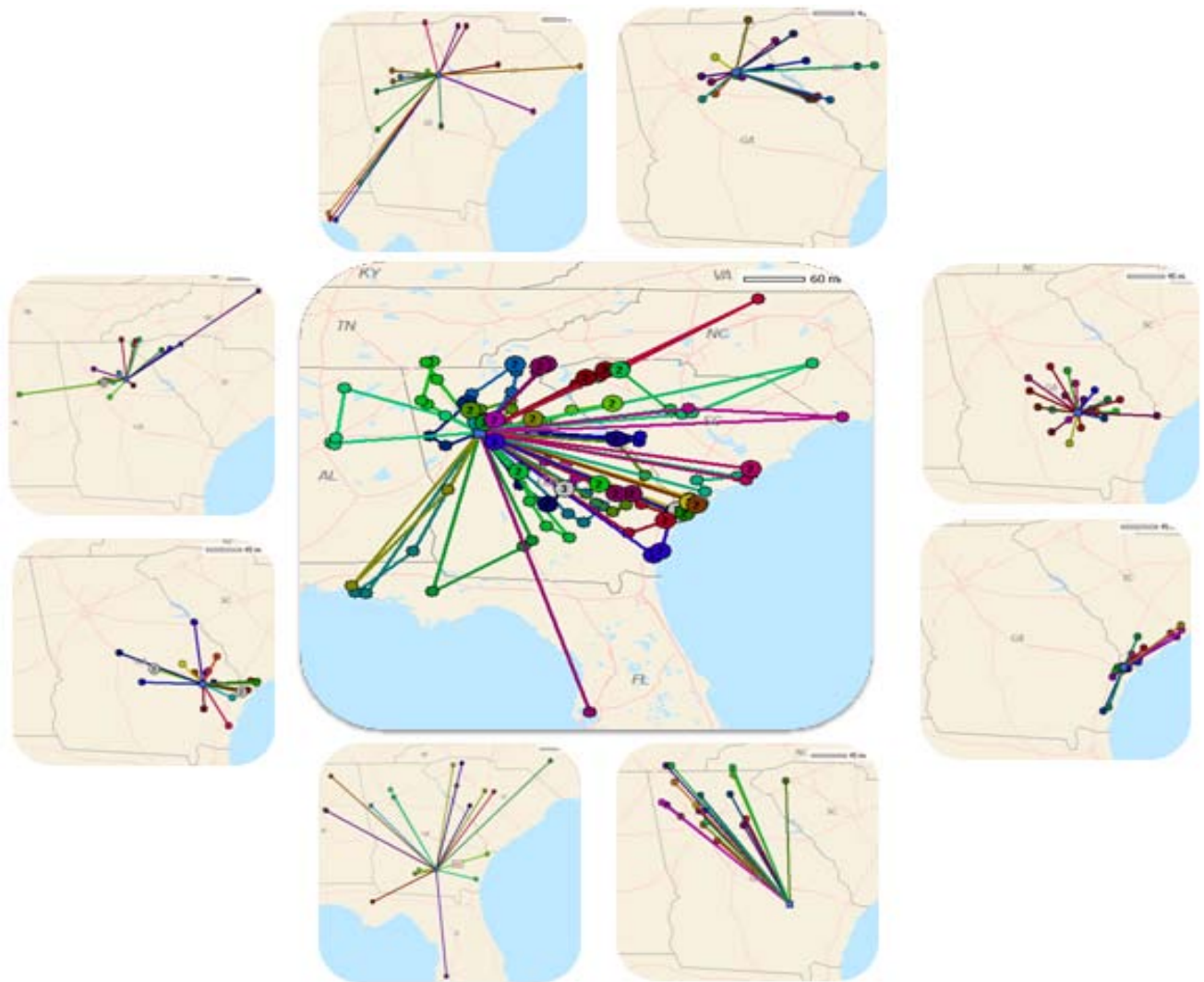


Figure 1. Order Sharing Routing Maps

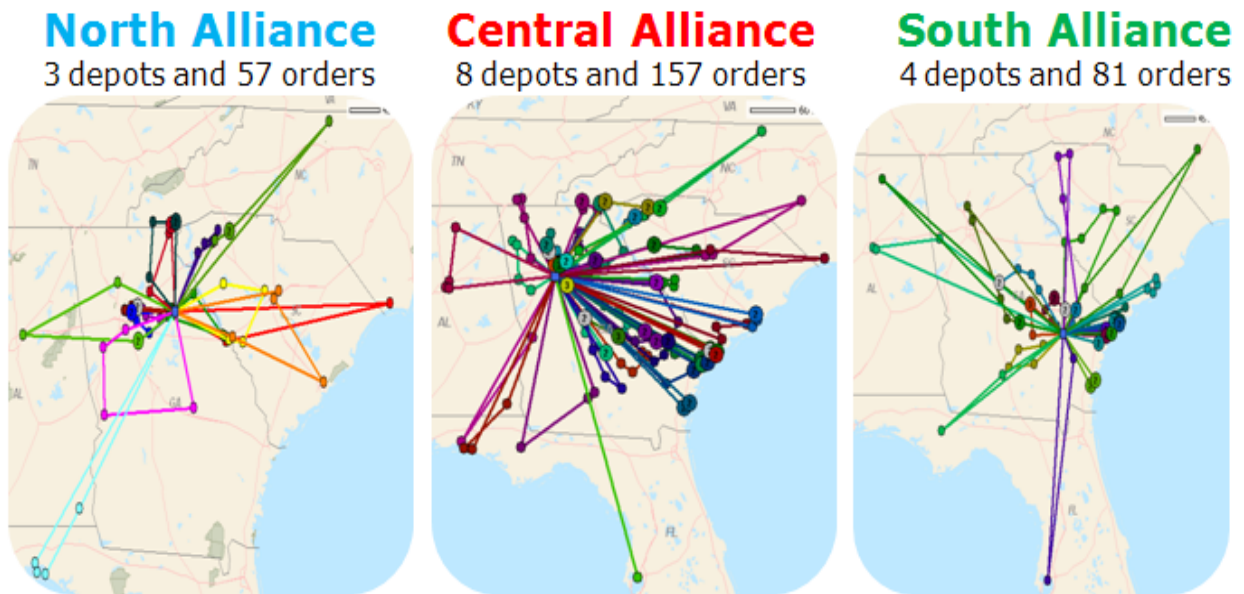


Figure 2. Location Clusters Routing Maps

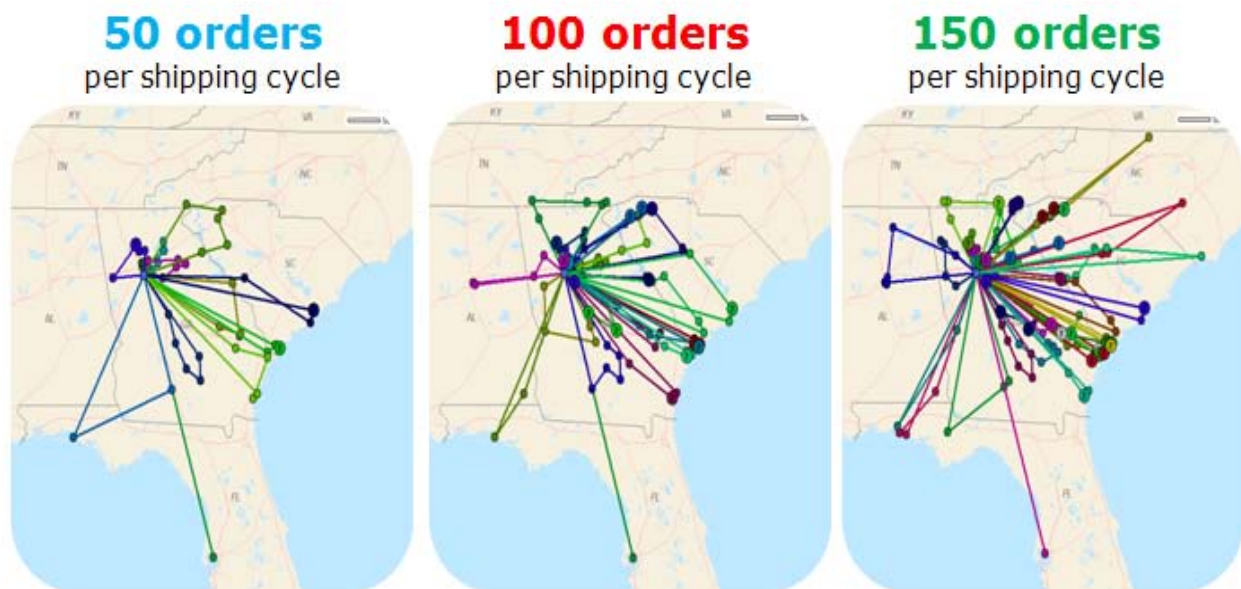


Figure 3. Optimal Numbers of Orders Routing Maps

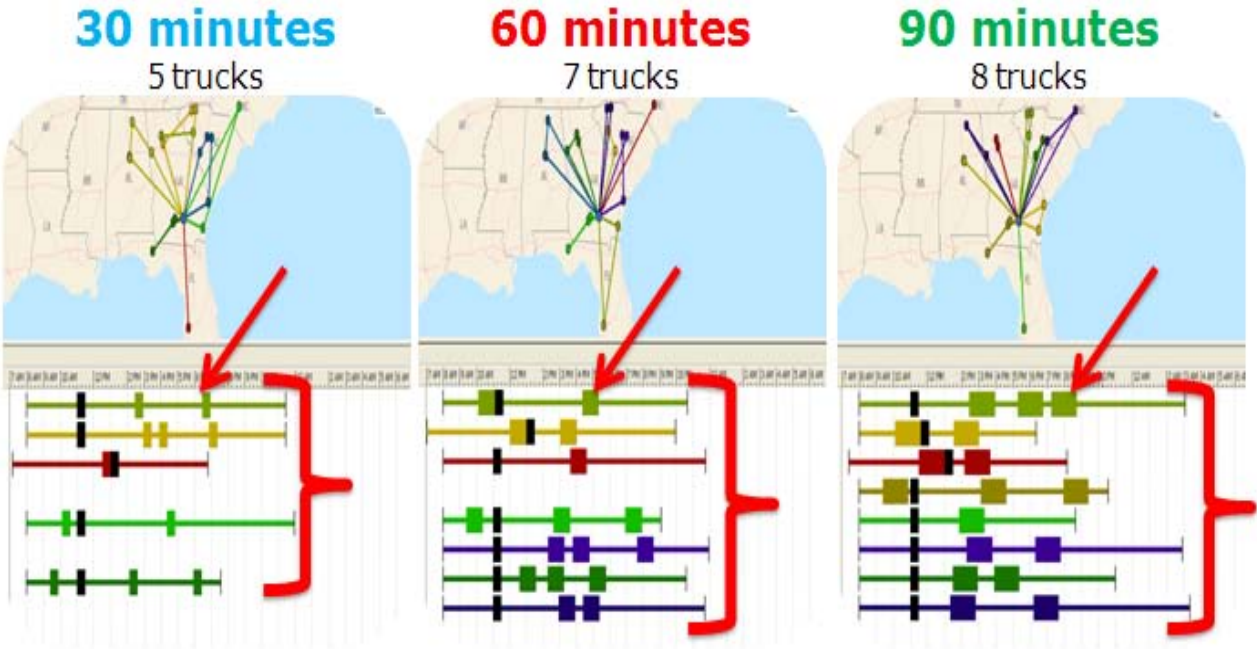


Figure 4. Time Windows Routing Maps

LOSS OF ACCREDITATION AND PROPERTY VALUES: A PRELIMINARY ANALYSIS OF CLAYTON COUNTY

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ABSTRACT

On September 1, 2008 the Southern Association of Colleges and Schools (SACS) revoked accreditation for Clayton County Public Schools (CCPS). Accreditation is a process designed to assure quality. Specifically, SACS had nine recommendations that the county failed to implement. By May 1, 2009, the school system had regained accreditation. The purpose of this paper is to study whether the loss of accreditation affected property values in Clayton County.

To assess the impact, this paper uses a hedonic pricing model. Hedonic pricing models are often used to study real estate values, since such models look at the various components that make up a house, such as number of bedrooms, the presence of a fireplace, whether there is carport or garage, and other relevant variables. .

INTRODUCTION

Clayton County, located south of Atlanta, has an estimated population of 280,000. Approximately 52% of the population is female and 60% are African American. Thirty percent of the population is under 18. Compared to the state, Clayton County has a slightly higher proportion of high school graduates (80%) and a lower proportion of college graduates (16.6%). The proportion living in poverty is about the same as the state (14.7%), while median income is lower (\$46,300 vs. \$50,800).

The CCPS is the fifth largest school system in Georgia. The system comprises 33 elementary schools, 13 middle schools, and 8 high schools. CCPS also has other district facilities to cater to differing student needs. The schools share facilities for other events, such as stadiums, the Performing Arts Center, and more. The system devotes considerable resources to faculty professional development, focusing on improving student learning.

In August 2008, the CCPS lost its SACS accreditation. The Southern Association of Colleges and Schools (SACS) is a division of AdvancED, a national organization formed to help schools improve organizational effectiveness and the quality of education. In January of 2008, SACS gave the CCPS nine recommendations to retain accreditation. Most of the mandates concerned the county school board. By the time of the August, 2008, visit, it became clear that the School Board had failed to comply with eight of the recommendations. (Mandate 7, listed

below, was met.) The recommendations were:

1. Establish a governing board that is capable of fulfilling its roles and responsibilities.
2. Remove the influence of outside groups/individuals that are disruptive to the work of the school district.
3. Enact and commit to an Ethics Policy that governs the actions and work of the members of the Board of Education and staff including appropriate steps when said policy is violated.
4. Implement a comprehensive review of board policies that includes training for board members on the purpose and expectations of said policies.
5. Conduct a full, forensic audit of financials by an independent, certified accounting firm and take appropriate steps to address the findings of such an audit.
6. Conduct a comprehensive audit of student attendance records and take appropriate steps to ensure that attendance records are accurate and meet legal requirements.
7. Ensure that each member of the Board is a legal resident of the county and is eligible to hold the elected seat on the Board.
8. Secure the services of outside consultants with expertise in conflict resolution, governance and organizational effectiveness.
9. Appoint a permanent superintendent with the experience and expertise to lead the school district and establish the proper conditions for effectiveness.

In February 2008, Governor Sonny Purdue appointed Glenn Brock, of Brock, Clay, Calhoun & Rogers, LLC, a Marietta-based law firm specializing in education and public policy, to assist the county in retaining accreditation. By May 2009, CCPS regained its accreditation.

As part of the process of maintaining SACS accreditation, CCPS hired Edmond T. Healy, Ph.D. to be the system superintendent. Dr. Healy began his tenure in July 2009 with a strategic planning session designed to assess the system, improve governance, and reduce the academic achievement gap of the students.

PROPERTY VALUES AND DEMOGRAPHICS

Property values depend on a number of characteristics of the home (number of bedrooms, square footage, presence of a deck), characteristics of the neighborhood, and location relative to amenities. One of the components of the value of real estate is quality of local education. Loss of accreditation could adversely affect real estate prices, since it will adversely affect college admission. As part of our initial data collection, we collected data on housing prices and other variables of interest to home buyers from homes that were sold in the southern Atlanta metropolitan area in the past several years.

According to the 2010 census (Hicks, 2010), Clayton County has the lowest median household income in the greater metro Atlanta area, as shown in Table 1.

Table 1: Comparison of Median Household Incomes

County	2000 Census	2005 – 2009 Census Average	Percent Change
Fulton	\$47,321	\$58,289	24%
Cobb	58,289	66,515	14
DeKalb	49,117	51,973	6
Gwinnett	60,537	65,136	8
Cherokee	60,896	66,248	8.7
Clayton	42,697	44,308	4
Fayette	71,227	81,206	14
Forsyth	68.890	88.040	28

One of the problems we will have to account for is the state of the economy. From August 2008 to December 2008, unemployment rates rose dramatically. Nevertheless, if the percent change in unemployment rates are the same across counties, we should be able to account for this. In addition, Schneider et al (2010) stated that areas such as Clayton County have a hard time maintaining living standards. As Table 2 shows, the poverty level has increased dramatically in Clayton County in the past several years (Hicks, 2010).

In addition, along with the accreditation issues, low median household income, and poverty, vacant housing is a significant problem in Clayton County (Schneider et al, 2010). This data is shown in Table 3 below.

METRO ATLANTA HOUSING PRICES: PRELIMINARY DATA

We would expect that the value of homes in nearby counties will be affected less than those in Clayton County. Michelle Shaw (2010) in one of several articles that she wrote for the Atlanta Journal Constitution, stated that home prices in Atlanta in October, 2010, were similar to home prices in 2000. In Clayton County, 57.7% of the property taxes collected go to the school system (Wickert, 2010). In Clayton County, the appraised value of all taxable property fell \$2.7 billion in 2010. This 11.9 % decrease was by far the largest of Atlanta's five largest counties; Clayton, Cobb, DeKalb, Fulton, and Gwinnett (Wickert, 2010). The 11.9% decrease in the tax values in 2010 in Clayton County followed a 4% decline in 2009.

Table 2: Poverty Levels of Specific Counties in Metro Atlanta Area

County	2000 Census	2005 – 2009 Census Average	Percent Change
Fulton	15.7%	15%	4%
Cobb	6.5	9	38
DeKalb	10.8	15	39
Gwinnett	5.7	10	75
Cherokee	5.3	7	32
Clayton	10.1	14.5	44
Fayette	2.65	4.3	65
Forsyth	5.5	5.4	2

Table 3: Vacant Housing in Specific Counties in Metro Atlanta Area

County	2000 Census	2005 – 2009 Census Average	Percent Change
Fulton	7.9%	17%	115%
Cobb	4.2	9	114
DeKalb	4.6	11	139
Gwinnett	3.5	9	157
Cherokee	4.7	8	70
Clayton	4.9	16	227
Fayette	3.7	6	62
Forsyth	5.3	8	51

The negative impact of the Clayton County School District was even included in the

Clayton State University's (CSU) School of Business Fifth-Year Maintenance Report to AACSB International (Ogbuehi, 2010). According to Dr. Ogbuehi, the "Clayton" brand was cited as a weakness, because many individuals think of Clayton County public schools instead of Clayton State University. Some of the other weaknesses cited were the "declining quality of traditional students" and the "declining quantity and quality of non-traditional students."

Home prices have fallen drastically in Clayton County and in most counties in the greater Atlanta area. Further, and in addition to falling home prices and other variables negatively affecting Clayton County, many home owners still pay more in taxes on the appraised value than what the homes are worth (Wickert and Perry, 2010). For example, a home was appraised for \$99,534 in 2009 and then reappraised by the county for \$ 55,790 in 2010. The home was then sold (by the government) for \$30,900 in 2010. Another bank owned home had an appraised value of \$87,511 in 2009. It was reappraised for \$40,549 in 2010, and was then sold as a bank owned for \$15,000 in 2010 (Wickert and Perry, 2010).

Clayton County's typical home appraised value in 2010 was \$90,589, a 25% decline from 2009 (Shaw, 2010). The mean sale price, however, was only \$80,656. Some owners have appreciated the reappraisals and the subsequent decrease in their county real estate taxes. Others, though, (Shaw, 2010) realize the negative effect that the reappraisal value of their home, especially if they want to sell it in the future.

The article by Shaw (2010) gave examples similar to what were given in the article by Wickert and Perry (2010). One home had an appraised value of \$97,614 in 2009. It was then reappraised for \$48,414 in 2010 and was sold as a bank owned home for \$29,912 on December 1, 2010.

In another thorough article another article published by the Atlanta Journal Constitution (Shaw, 2010), it was indicated that home foreclosures have had a devastating effect on the Clayton County real estate market. As a result of the large differential between current home sales and previous county appraisals, more than 85 percent of all residential property was reevaluated by the Clayton County tax commissioner in the spring, 2010. As a result of the reevaluation, the tax digest for the county decreased by over \$2 billion dollars in 2010.

The foreclosure market is driving the sale of homes in Clayton County. Of the 1,302 sales in 2009, 581 were bank sales (Shaw, 2010). Rodney McDaniel originally didn't feel that the foreclosure sales could get any worse than last year, but he stated in the article by Shaw (2010) that the foreclosures are having an even larger effect during 2010. The number of foreclosures in Clayton County has increased exponentially in the past several years. In all of 2003, Clayton County had 3,404 foreclosures. From January 1, 2010 through November 31, 2010, there were already 9,676 foreclosures (Quinn, 2010). Another article (Edwards, 2010), pointed out that foreclosure were four times more prevalent in the south Atlanta area than in north Atlanta. There were several reasons for this, including the perception that schools are

superior in north Atlanta, there is less crime in north Atlanta, and the south Atlanta area has a less desirable standard of living (Edwards, 2010).

SUMMARY AND REFLECTION

In this paper, we have done a preliminary analysis of the impact of the loss of SACS accreditation on home prices in Clayton County. While home prices in the metro Atlanta area declined as a result of the recession, there is some evidence to suggest that Clayton County experienced a greater decline. It is difficult to say if the continued decline is the result of the economy, continued uncertainty about the school system, or other demographic factors. To further explore these ideas, we will develop a hedonic pricing model (Hansen, Bensen, and Hagen, 2006 and Lang, 2004) to account for other factors that influence home values, including square footage, number of bedrooms, and characteristics of the neighborhood.

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ROLE AND MODELS OF OPTIMISM IN CORPORATE MANAGEMENT

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ABSTRACT

Managerial optimism can be modeled based on rational or behavioral assumptions. The results and predictions from incorporating behavioral assumptions, sometimes agree with the traditional framework, and sometimes provide further insight and implications. We follow the trend of modeling techniques, used for formalizing managerial optimism, in the corporate literature to elaborate the great potential of valuable implication arising from pursuing a comprehensive framework that captures this empirically observed prevalent trait of corporate managers.

MODELING MANAGERIAL OPTIMISM WITHOUT INVOKING ASYMMETRIC INFORMATION OR RATIONAL AGENCY COSTS (J. B. HEATON, 2002):

Experimental psychology provides evidence that people represent high levels of optimism in two cases. One is when they believe that they have more than a certain level of control over the outcomes, like the control over firm's procedures as a manager. The other case is when a high (and personal) level of commitment is involved, such as managers' own job and his benefits in relation to the prospect of success for the firm. Managerial irrationalities are protected by larger arbitrage bounds than irrationality in asset pricing, where markets exploit arbitrage opportunities. A prime example is found in pursuing corporate takeovers that involve high transaction costs. Another instance can be observed in corporate cultures that promote irrationalities, since riskier management styles are rewarded better than rational strategies. Finally, principals can exploit managerial irrationalities through incentive mechanisms that correspond to high-risk behavior resulting in real expected utilities, which are lower than perceived expected utility. This kind of behavior usually results from optimistic assessment of abilities on the managers' side.

Takeover activities have been of major interest in academic studies, leading to two frameworks that disagree about the value of free cash flow. One view holds that free cash

flow is beneficial, assuming that managers are committed to maximizing value for existing shareholders. In this case, managers use their superior information to avoid value destruction that can occur from issuing undervalued securities to an under-informed capital market to finance a new positive present value project (Myers and Majluf, 1984). The alternative view allows for shareholder/managers conflict of interests. This conflict can then be mitigated pay out of free cash flows that in turn adds value for shareholders (Jensen, 1986). Heaton (2002) reconciles these two views, asymmetric information and rational agency costs, into one framework by assuming managerial optimism.

Optimist managers hold that efficient capital markets undervalue their issued securities, which leads to preferring internal funding and in case of insufficient internal funding to possible rejection of positive present value projects to avoid high cost of external funding. In this case, free cash flow provides for funding new projects internally and saves the firm from potential rejection loss arising from incorrect costs perceived by the optimist manager. That is, optimistic managers are less likely to finance new projects internally, which leads to underinvestment in good projects that can increase value for shareholders. Therefore, it is rational for shareholders of optimistically managed firms to prefer more free cash flow when investments opportunities are good and to prefer less free cash flow when investment opportunities are bad. Heaton (2002) models high managerial optimism in two types of firms, one type has good investment opportunities, whereas, the other type of firms have bad investment opportunities. In this approach there is no need to consider neither information asymmetry that makes use of superior managers' information compared to the capital market, nor it is required to account for agency conflicts between rational managers and shareholders. The optimist manager model is more parsimonious than both models it reconciles in that it can produce predictions of both models with less variables and less assumptions. Despite using a behavioral assumption (optimism) it remains to be an "as-if" model, and cannot fully resolve the debate of just how realistic the model assumptions might be. The optimistic manager model assumes away both informational asymmetry and agency conflict costs. Moreover, in this model the capital market is assumed fully rational, therefore securities are priced efficiently and reflective of discounted expected cash flows with correct probability distributions. Managers are assumed optimistic in relation to a risk neutral rational market. Finally, the discount rate is assumed to be zero, so is the tax and cost of financial distress.

The model has three dates, $t = 0, 1, 2$, and two states of cash flow, B=bad and G=good. Investment K is made at time $t=0$. Cash flow at $t=1$, y_1 is certain, whereas, cash flow at $t=2$ can be in either state, G or B, such that ${}_G y_2 > {}_B y_2$ with true (T) probabilities ${}_{TP}G$ and ${}_{TP}B$, respectively, and ${}_{TP}G + {}_{TP}B = 1$. All information is known at $t=0$. That is market and managers hold same beliefs about all values except probabilities; optimistic managers hold a higher probability for the good state than the objective probability. At time $t=1$, the firm faces an opportunity for an investment I , which can return a high (H) or low (L) payoff, such that $r_H > r_L$ with true probabilities ${}_{TP}H$ and ${}_{TP}L$, and ${}_{TP}H + {}_{TP}L = 1$. Again, this is known information to all, and optimistic managers don't believe in true probabilities.

Managerial (M) optimism is defined as $m_{PG} > t_{PG}$ and $m_{PH} > t_{PH}$, where $m_{PG} + m_{PB} = 1$ and $m_{PH} + m_{PL} = 1$.

This model of managerial optimism provides predictions about perceptions of external finance, cash flow forecasts, and the value of free cash flow. For instance, optimistic manager hold that the market undervalues their firms' securities, and so issuing risky security has negative present value. The pecking order capital structure resulting from an optimistic view seeks to minimize issuance of risky securities in favor of using internal cash and/or issuing risk-free securities that are not sensitive to probabilistic beliefs. Therefore, in case of cash shortage, the optimistic manager issues risk-free debt, not equity. Moreover, optimistic managers might reject a positive NPV project because of their subjective beliefs about external financing high costs. Finally, even while loyal to shareholders, optimistic managers might undertake negative NPV projects because of their high subjective beliefs in high returns and good states.

MANAGERIAL OPTIMISM CAN MITIGATE BONDHOLDER-SHAREHOLDER CONFLICTS (DIRK HACKBARTH, 2009):

For each investment decisions there exist variety of financing choices with different implications on value for shareholders versus bondholders. In the last section, we presented arguments for the existence of managerial optimism in investment decisions. Here, we brief Hackbarth's (2009) view of some advantages of managerial optimism. Hackbarth models managers as rational agents in every aspect, except their optimistic beliefs about riskiness of assets in place. These optimistic managers are loyal to shareholders, and so their rational goal remains to be maximizing value of equity, however, since they hold subjective beliefs about the future value of assets, this maximization is a perceived value maximization as opposed to an objective one. That is, the managers use subjective probabilities that correspond to overvalued assets. These managers serve a rational body of principals, i.e., bondholders and shareholders are simply rational. Rational investors are fully informed, which implies efficient pricing of corporate securities.

The perception of growth held by the managers sets the amount of investment, the combination used for financing a certain investment, and the timing of managerial choices that affects bondholders and shareholders values. Optimistic managers hold beliefs implying higher than objective likelihood of growth. This view, leads to higher amounts of investment (a fact that is supported by surveys), and in turn provides favorable results that alleviate bondholder-shareholder conflicts in a debt-equity financed firm. Notice that a direct implication of (perceived) higher growth rate, held by optimistic managers, is a lower probability for default leading to a later initiation of asset sales.

Hackbarth's model has several testable predictions, from which we only report the following. " In contrast to unlevered firms, levered firms' shareholders should therefore

rationally seek out the labor market of managers for candidates who are mildly optimistic and/or overconfident, and allowing also for optimism about future investment benefits can further strengthen the positive role of biased managers.” The reason is, as Hackbarth formally shows, that perception biases arising from a mild level of optimism acts equivalent to commitment to first-best real option exercise strategies of debt-equity financed firms. Recall that a second-best, a more frequent strategy, is to focus on equity value maximization as opposed to the first-best strategy of maximizing the whole firm value. Notably, same result can be arrived at by imposing mild optimism on general principal-agent problem, and hence the same recommendation for hiring optimistic managers can be deducted without attending to the underlying psychology and behavioral conceptions. So, is there is a need for behavioral models, and a use for their implications, above and beyond what traditional agency conflict plus asymmetric information can produce? While Hachbarth labels mild managerial optimism as a “self-serving bias” or as “positive illusions produc[ing] beneficial consequences,” there is still more merit to the study of managerial optimism from a behavioral viewpoint as we lay out next.

EXCESSIVE MANAGERIAL OPTIMISM AND DEBIASING TECHNIQUES (HERSH SHEFRIN, 2007 & 2010):

Conventional wisdom tells us that too much of a good thing, can be bad. Excessive optimism is a case in point. Whereas, mild optimism can be beneficial for specific firms, perceiving too high growth rates, abnormal likelihoods of high return, or unreasonable expectations of future good states can lead to managerial choices which destruct firm value. To prevent undesirable consequences of excessive optimism, we must understand the nature of the phenomenon. If all there is to optimism can be captured in a rational agent models, then recommendations for remedy can also be obtained such. However, if there is more to optimism than included in rational models, then we can find resolutions only by acknowledging and modeling the behavioral component involved in the phenomenon. “Behavioral phenomena and agency phenomena are both central to corporate finance. There are two main issues involving the relationship between agency phenomena and behavioral phenomena. (1) a key challenge is to differentiate them clearly, so behavioral issues do not come [to] be regarded as rational agency issues. (2) there is a whole behavioral dimension to the treatment of agency problem.” The behavioral treatment of a general problem, such as agency conflicts, or shareholder-bondholder conflicts is two fold: (1) development of behavioral solution concepts that provide formal basis for a behavioral framework, and (2) develop models with a particular focus of understanding behavioral biases with the goal of constructing debiasing. A formalized behavioral framework can predict undesirable outcomes, and furthermore generate mechanisms for avoiding such outcomes. Shefrin (2008) coins the term “psychologically smart organizations,” which build and operate based on a corporate culture that is sensitive to human incentives and motivations. A psychologically smart firm elicits efficient and sustainable decision-making processes from managers (and all employees), whereas ignoring psychological and contextual realities in firm leads to disasters. PB’s corporate culture prior to the Gulf spill, is a recent illustration of the latter. The set of methods and strategies that help mangers improve their judgment and

overcome excessive biased views is referred to as “*debiasing*.” Once it becomes clear that optimism results from an illusion of excessive control over outcomes, this can be corrected by mechanisms that refine managers’ beliefs about the actual amount of possible control. Such objective beliefs, for example, can be provided by inviting outsiders to present their views in management and board meetings. Optimistic managers might accept negative NPV projects or keep such projects because they overestimate the likelihood of success. This kind of value destructing behavior can be rectified by a simple exercise of putting yourself in the shoes of a new manager who has just entered the firm, this manager most likely will follow objective rules of valuation and hence will terminate negative NPV projects.

All existing models of financial decision-making formulate deviations from rationality only on one side, agent or principals. The case we reviewed above involved irrational managers, such as an optimistic managers, facing fully rational capital market and investors. The other case, rational managers making decisions in an irrational market, has been less explored (an example is Stein, 1996). Shefrin (2007) “devote[s] a chapter to discussing interactions between non-rational principals and non-rational agents.” Shefrin work (e.g., 2007, 2008, & 2010) provide a joint finance-psychology viewpoint for corporate and investment decision-making. Shefrin argues extensively about behavioral biases, such as managerial optimism, and its close counterpart overconfidence and provides guidelines towards a formalized framework within which many questions can be answered. Such framework can produce reference values for items discussed in this paper, issues such as specifying a beneficial level of optimism in corporate decision-making, and ways in which managers can avoid excessive optimism which can be value destructing.

MANAGERIAL OPTIMISM: HINDRANCE OR ADVANCE?

Optimism is a subjective risk perception, in which the risk of good events are overestimated and risk of undesirable events are underestimated. Optimistic agents who make decisions on the basis of such probability distributions, which do not match objective probabilities, are prone to being surprised more often than they expect by outcomes that are not desirable to them. However, being optimistic has its own advantages in corporate decision-making. Just how much optimism is beneficial? How can it be exploited towards additional investors’ welfare, and when is it too much and requires remedy? Where could remedies be found? We briefly reviewed the very first model of managerial optimism, as well as a recent model of this phenomenon – both designed to replace the traditional agency problem construct. Also, we highlighted phrases from most recent and extensive survey of behavioral corporate finance on ways in which managerial optimism have been viewed, modeled, and conceptualized in the financial literature. Data from surveys and otherwise confirm the widespread presence of optimism in the practice of corporate management, accentuating the study of this phenomenon of special high relevance to understanding, predicting, and enhancing many corporate decisions.

Managerial optimism in corporate decision-making is manifested in overestimation of good firm performance as well as underestimation of bad firm performance. These beliefs about performance impacts the cost-benefit analysis that in turn leads to acceptance (and/or retaining), or rejection of projects, which would otherwise be treated differently. Traditionally, managerial hubris (optimistic view) has been considered as an agency problem, and modeled accordingly. Starting with Heaton's 2002, an effort to modeling hubris without reference to agency costs was formed. Hackbarth (2009) extended this modeling approach and demonstrated advantages of optimistic managerial beliefs. Shefrin (2007 & 2010) took one step further and argued that managerial optimism must be understood as a twofold phenomenon, and therefore cannot be controlled only through solutions derived from the rational model. We juxtaposed these models and views to provide perspective on a nascent approach and to emphasize the importance of modeling managerial hubris in the corporate finance academic and practitioners' research and literature. The main insight that can be gained from enhancing this line of research appears in at least two ways: constructing practical debiasing techniques, which reduce systematic value destructions; and exploiting behavioral biases that generate value in certain contexts.

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RATES OF RETURN YOU CAN TRUST

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INTRODUCTION

This study extends several previous investigations of the bias introduced using various naïve and derived forecasting models to predict returns in financial investments over varying time horizons. Previously, a limited number of historical periods were employed to test the effectiveness of Marshall Blume's weighted average formula to forecast future expected returns for various investment horizons, comparing the forecasts against the actual returns. The alternative forecasts included the two components of Blume's formula, namely the arithmetic and geometric mean. This present study more rigorously and systematically tests all legal historical periods from available data against all legal future ones using all three; Blume's weighted average, arithmetic, and geometric averages. Additionally, this study explores variations on Blume's model in search of better forecasts, and the least, a better measure of historical returns that can be used to inform future expectations.

BACKGROUND

Forecasting expected returns based on historical data violates some conditions of the efficient market hypothesis, however, many rely on historical returns to measure historical investment performance, and to some extent, to shape performance expectations. The choice of historical returns measurement can, and does, result in varied results. Marshall Blume addressed this through a simulation approach to test the bias of arithmetic and geometric models [1]. He constructed values within a narrow range with a defined set of parameters, which arguably do not represent actual returns. His conclusions, however, have been applied to real world applications in investment.

While not a new question, others have challenged the choice of mean returns measures and the correct choice depends upon the question asked and this depends upon the environment. This paper addresses the investment in financial securities to evaluate (1) the appropriate measure of returns, and then, (2) the efficacy of the measures on expected returns.

DATA AND METHOD

Similar to prior studies, annual closing values for the DJIA and S&P 500 are used as the basis for generating historical and forecast returns. All available (legal) historical periods are used to forecast each n-periods as investment horizons. Each n-period return (historical and forecast) is calculated using either arithmetic or geometric approaches where the returns using the arithmetic mean for time period “t” (A_t) are given by:

$$(1) \quad A_t = \frac{1}{n} \sum_{i=1}^n (1 + r_i) - 1$$

Similarly, rates of return using the geometric mean for time period “t” (G_t) are given by:

$$(2) \quad G_t = \sqrt[n]{\prod_{i=1}^n (1 + r_i)} - 1$$

Blume’s [1] formula, as adapted by Ross, *et al.* [8], suggests using a weighted average of the geometric and arithmetic means of annual values to generate an expected return B_t (Blume’s Average) where the weighting factors are determined as the proportion of the forecast period to the historical review period, such that,

$$(3) \quad B_t = G_t \left(\frac{T-1}{N-1} \right) + A_t \left(\frac{N-T}{N-1} \right)$$

where N is the number of periods of historical data used and T is the forecast horizon.

Forecasts for T periods will be generated for all available N-periods under each of the three averaging approaches. The goal is to examine the degree to which each method systematically over- or under-predicts the returns for the forecast horizon (using a Mincer-Zarnowicz approach), the accuracy of each forecast (using Diebold’s d test), and a search for a model for establishing realistic expectations of future returns that out-performs the three models tested here.

RESULTS

Please contact the first author for complete results.

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An Update of ABET Accreditation of IS Programs

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ABSTRACT

Most IS/CIS/MIS programs are in Schools/Colleges of Business. When AACSB accredits the School/College of Business, the IS programs are included in the accreditation. AACSB has a special accreditation for accounting but so far there is no special AACSB accreditation for IS.

ABET has been the accreditation agency for engineering and computer science programs for many years but in 2002 ABET accredited an IS program at Pace University. In 2005 there were over 250 IS programs accredited by AACSB that were in business programs in universities and in 2005 there were 10 IS programs accredited by ABET. In 2010 there are 36 IS programs accredited by ABET. This paper looks at the characteristics of the IS programs accredited by ABET and looks at common characteristics for these programs.

INTRODUCTION

AACSB was founded in 1916 and has been accrediting business and accounting programs for many years in the US and all over the world. Although there is a separate accreditation for accounting, AACSB does not have separate accreditation for information systems, marketing or finance. By July 2010 AACSB has accredited 586 business programs. Thus when AACSB accredits a business school/college, information systems, marketing and finance come under the accreditation umbrella.

There have been discussions of IS accreditation for many years and many faculty suggested that AIS should be the accrediting agency for IS. For whatever reason, this has not happened and the cost of running an accreditation was likely a major concern. Many papers have been written in recent years on the topic of IS accreditation see Challa(2005), Gorgone (2003 & 2004), Hilton (2003, 2003 & 2007), Jones (2004), Kohum (2003 & 2004), MacKinnon (2005), Reif (2009) and Topi (2009). However, AIS has not decided to accredit IS.

ABET was founded in 1932 to accredit engineering programs and for 75 years has been the standard accreditation agency for engineers. In 1985 ABET started accrediting computer science programs and in 2002 ABET accredited the first IS program. In 2010 ABET accredits a total of 3,100 engineering and computing

programs. This paper will look at the IS programs accredited by ABET and see if there are any common characteristics among their IS programs.

Table 1. ABET Accredited IS Programs in 2005

#	University	Year Accred	IS Degree	Department	IS Title	College
1	Drexel U	2003	BS	None	IS	IS & Technology
2	Illinois State U	2003	BIS	School of IT	MIS	School of IT
3	Kennesaw State U	2004	BS	CS & IS	IS	C of Science & Math
4	U of Nebraska, Omaha	2004	BS	IS & Quant	MIS	C of IS & Technology
5	NJ Institute of Tech	2004	BS	IS	IS	C of Computing Sciences
6	U of North Florida	2003	BS	C & IS Sciences	IS	School of Computing
7	Pace U	2002	BS	None	IS	School of CS & IS
8	Robert Morris U	2003	BS	CIS	ISM	School of Comm & IS
9	U of South Alabama	2003	BS	C & IS	IS	School of Computer & IS
10	Virginia Commonwealth U	2003	BS	IS	IS	<i>School of Business</i>

Early ABET IS Accreditation

In looking at Table 1 it is a challenge to see what these IS programs have in common. However, a few characteristics stand out. Most IS programs are in Schools/Colleges of Business and the IS degree offered is usually a BBS IS. Looking at Table 1 there is not a single BBS IS degree. All the IS degrees at these universities are BS degrees. Why? Look at the college column. Only one of these IS programs is in a business School/College. At one time business programs had a 50% rule where there was a limit on the number of IS courses you could take. If an IS program was not in a business college it would not have these restrictions and could include more IT or technical courses. The first professors that investigated the IS programs were computer science professors and it is possible that they might have looked for strong technical programs. It is also noted that these first 10 IS programs that were accredited are not from major universities. One might speculate that these IS programs sought ABET accreditation since AACSB accreditation was not available.. However, if you look at table 2, this is not true, 9 out of 10 of these universities also have AACSB accreditation.

Table 2. ABET IS Accredited Characteristics in 2005

University Names	ABET IS Accredited Year	ABET IS Degree Name	Existence of BBA IS	Existence of CS Degree	Bus AACSB Accred
Drexel U	2003	BS	Y	Y	Y
Illinois State U	2003	BIS	BIS	Y	Y
Kennesaw State U	2004	BS	N	Y	Y
U of Nebraska, Omaha	2004	BS	N	Y	Y
NJ Institute of Tech	2004	BS	N	Y	Y
U of North Florida	2003	BS	N	Y	Y
Pace U	2002	BS	Y	Y	Y
Robert Morris U	2003	BS	N	SE	N
U of South Alabama	2003	BS	N	Y	Y
Virginia Commonwealth U	2003	BS	N	Y	Y

Recent ABET Accreditations

In 2002 ABET accredited 2 IS programs. Table 3 shows the growth of ABET IS accreditation. After 7 years ABET has accredited 36 IS programs. There are over 250 IS programs in the US, so 36 is not a large number and it looks like being ABET accredited is not yet a strong requirement for IS programs.

Table 3. Number of IS and IT Programs Accredited by Year

Year	# of IS Programs	# of IT Programs
2002	2	
2003	5	3
2004	2	1
2005	5	2
2006	10	2
2007	6	5
2008	4	2
2009	2	0
Total	36	15

Characteristics of ABET Accredited IS Programs.

Tables 4 and 5 have the characteristics of the 36 IS programs that are currently accredited by ABET. There have been some changes. In 2010 there are now 10 IS programs that are ABET accredited that are in business/management colleges, compared to 1 in 2005. However only 2 of the 36 IS degrees are BBA IS degrees. It is still common that ABET IS programs that are accredited are BS degrees. There is still a wide variety of what information systems is called and it could be IS or CIS or MIS or BIS or ISM. There is also a wide variety of the titles of the departments where IS is located but it appears that 17 of these universities have computer science and IS in the same department. Since most computer science programs are accredited by ABET there could be a strong pressure for IS to also get ABET accredited. In table 2 it can be seen that there are now 15 IT programs accredited by ABET. If your university has CS and IT programs accredited by ABET, there could be considerable pressure for IS to also get ABET accreditation.

Table 4. ABET Accredited IS Programs in 2010

#	University	Department	IS Title	College
1	Arkansas, Little Rock	Management	MIS	<i>Business</i>
2	Arkansas Tech	<i>Computer & Information Science</i>	IS	College of Applied Sciences
3	CSU, Chico	None	MIS	<i>Business</i>
4	California U of Pennsylvania	<i>Math, CS & IS</i>	CIS	C of Sc & Tech
5	Drexel U	None	IS	IS & Technology
6	Fitchberg State College	<i>Computer Science</i>	CIS	None
7	Florida Memorial U	<i>Computer Science, Math & Tech</i>	CIS	School of Arts & Sciences
8	Gannon	<i>Computer & Info Sciences</i>	MIS	College of Hum, Bus & Educ
9	Grand Valley SU	<i>Computing & IS</i>	CIS	School of Computing & IS
10	Houston, College of Tech	Info & Logistics Technology	CIS	College of Technology
11	Houston-Clear Lake	<i>Comp & Math Division</i>	CIS	School of Sci & Engineering
12	Illinois State U	School of IT	MIS	School of IT
13	Jacksonville SU	<i>Math, Computing & IS</i>	CIS	College of Arts & Science
14	James Madison	CIS & Mgmt Sci	CIS	<i>College of Business</i>
15	Kennesaw State U	CS & IS	IS	Science & Math
16	Lock Haven	<i>Bus, CS & IT</i>	CIS	College of Arts & Science
17	Maine	SIS & Engineering	ISE	Engineering
18	Metropolitan S College	CIS	MIS	<i>School of Business</i>
19	U of Nebraska, Omaha	IS & Quant	MIS	IS & Technology
20	NJ Institute of Tech	IS	IS	Computing Sciences
21	U of North Alabama	<i>Computer IS</i>	CIS	<i>Business</i>
22	U of North Florida	<i>C & IS Sciences</i>	IS	Engin & Construction
23	Pace U	None	IS	School of CS & IS
24	Quinnipiac U	Info Sys Mgmt	ISM	<i>School of Business</i>
25	Radford U	Information Technology	IS	College of Sc & Tech
26	Robert Morris U	CIS	ISM	School of Comm & IS
27	Rowan U	None	MIS	<i>Business</i>
28	U Scranton	<i>Computer Sciences</i>	CIS	<i>School of Management</i>
29	Slippery Rock	<i>Computer Science</i>	IS	Bus, Info & Social Sci
30	U of South Alabama	C & IS	IS	School of Computer & IS
31	U South Carolina	<i>Computer Sci & Engineering</i>	BIS	C of Engin & Computing
32	Southern Utah U	<i>CS & IS</i>	IS	C of Computing Integ & Tech
33	Utah S U	<i>Computer Science</i>	CS	College of Science
34	Utah Valley U	IS & Tech	IS	College of Tech & Computing
35	Virginia Commonwealth U	IS	IS	<i>School of Business</i>
36	Wright SU	IS & Oper Mgmt	MIS	<i>College of Business</i>

Table 5. ABET IS Accredited Characteristics in 2010

University	Year ABET Accred	ABET IS Name	Existence of CS	Existence of IT	Existence of BBA IS	Bus AACSB Accred
Arkansas, Little Rock	2006	BS	Y	N	Y	Y
Arkansas Tech	2006	BSIS	Y	Y	N	Y
CSU, Chico	2008	BBIS	Y	N	N	Y
California U of Pennsylvania	2008	BS	Y	N	N	N
Drexel U	2003	BS	Y	Y	Y	Y
Fitchberg State College	2006	BS	Y	N	BSCIS	N
Florida Memorial U	2008	BS	Y	N	N	N
Gannon	2006	BS	Y	N	N	N
Grand Valley SU	2007	BA/BS	Y	N	BA BS	Y
Houston College of Tech	2009	BS	N	N	N	N
Houston-Clear Lake	2006	BS	Y	N	BS CIS	Y
Illinois State	2003	BIS	Y	N	BIS	Y
Jacksonville S	2005	BS	Y	N	Mgmt/IM	Y
James Madison	2005	BBA	Y	N	Y	Y
Kennesaw SU	2004	BS	Y	Y	N	Y
Lock Haven	2005	BS	Y	N	N	N
Maine	2007	BS	Y	N	N	Y
Metropolitan SC	2007	BS	Y	N	N	N
Nebraska, Omaha	2004	BS	Y	PhD	N	Y
NJ Inst of Tech	2003	BS	Y	Y	N	Y
U of North Alabama	2006	BBA	Y	N	Y	N
North Florida	2002	BS	Y	Y	N	Y
Pace U	2002	BS	Y	Y	Y	Y
Quinnipiac U	2007	BS	Y	N	N	Y
Radford U	2008	BS	Y	Y	N	Y
Robert Morris U	2003	BS	SE	N	N	N
Rowan U	2006	BS	Y	N	BSMIS	Y
U Scranton	2005	BS	Y	N	N	Y
Slippery Rock	2005	BS	Y	Y	N	N
South Alabama	2006	BS	Y	Y	N	Y
South Carolina	2006	BS	Y	N	N	Y
Southern Utah U	2009	BS	Y	N	N	Y
Utah SU	2007	BS	Y	N	BA	Y
Utah Valley U	2007	BS	Y	Y	N	Y
Virginia Commonwealth	2003	BS	Y	Y	N	Y
Wright SU	2006	BSB	Y	N	N	Y

What About The Top Ranked IS Programs?

Table 6 lists the top 10 IS programs as rated by US News (2010). All these IS programs are AACSB accredited and all of them are in schools or colleges of business or management. Information systems could be called MIS or IS or CIS like most other universities. It is also noted that none of these IS programs are ABET accredited.

Table 6. Top Ranked IS Programs in US News 2010

Rank	University	Dept	IS Name	College	AACSB Accred	ABET Accred	BBA IS	Pr Pub
1	MIT, Sloan	None	Mgmt Sc	SOM	Y	N	N	Pr
2	Carnegie Mellon, Tepper	Track	C & IT	SOB	Y	N	N	Pr
3	Texas Austin, McCombs	IROM	MIS	SOB	Y	N	BBA	Pub
4	Minnesota, Carlson	None	MIS	SOM	Y	N	BSB	Pub
5	Arizona Eller	MIS	MIS	COM	Y	N	BSBA	Pub
6	Maryland, College Park Smith	None	IS	SOB	Y	N	BS	Pub
7	Pennsylvania, Wharton	OIM	IS	COB	Y	N	N	Pub
8	New York, Stern	Track	IS	SOB	Y	N	Y	Pub
9	Stanford	None	IS	SOB	Y	N	No	Pr
10	Georgia State, Robinson	CIS	CIS	COB	Y	N	BBACIS	Pub

Conclusion

In the above tables there are a few characteristics that stand out. Most ABET accredited IS programs are not in schools/colleges of business/management and the IS degree offered by ABET accredited program is usually a BS degree. There is a wide variety of universities listed in Table 4 but you generally would not call these universities major universities. None of the large universities like Minnesota, Arizona, Texas, Michigan, Wisconsin and Ohio State are ABET accredited for IS.

The growth of the ABET accredited IS programs has been slow but steady. Unless AIS starts a new IS accrediting program, the IS ABET growth could continue as it has been for the past 8 years. ABET accreditation is now the “gold standard “ in engineering and computer science but it has not yet reached this level for information systems.

If you would like to investigate the ABET accredited IS programs further, Appendix A contains the URLs of these programs.

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Appendix A. ABET Accredited University URLs 2010

University	Department	Title	URL
Arkansas, Little Rock	Mgmt	MIS	www.ualr.edu/bba/mgis/
Arkansas Tech	Computer & IS	IS	www.ualr.edu/bba/mgis/
CSU, Chico	None	BIS	www.csuchico.edu/cob/prospective/explore/majors.shtml
California U of Pennsylvania	Sc Tech & Business	CIS	www.calu.edu/academics/programs/index.htm
Drexel U	None	IS	www.ischool.drexel.edu/Home
Fitchberg State College	Computer Science	CIS	www.fsc.edu/acadaff/departments/compsci.cfm
Florida Memorial U	Computer Sc, Math & Tech	CIS	www.fmuniv.edu/
Gannon	C & IS	MIS	www.gannon.edu/PROGRAMS/UNDER/mis.asp
Grand Valley SU	Computing & IS	IS	www.gvsu.edu/
Houston College of Tech	Info & Logistics Tech	CIS	www.tech.uh.edu/
Houston-Clear Lake	Comput & Math	CIS	www.uhcl.edu/portal/page/portal/SCE/
Illinois State U	School of IT	MIS	www.ilstu.edu/home/academics/
Jacksonville SU	Math, C & IS	CIS	www.jsu.edu/depart/ccba/
James Madison	CIS Mgmt Sci	CIS	www.jmu.edu/cis/
Kennesaw State U	CS & IS	IS	science.kennesaw.edu/csis/
Lock Haven	Bus, CS & IT	CIS	www.lhup.edu/comp_sci/index.html
Maine	SIS & Engin	ISE	www.umaine.edu/about/academicprograms/
Metropolitan S C.	CIS	MIS	www.mscd.edu/%7Ecmsdept/
U of Nebraska, Omaha	IS & Quant	MIS	www.isqa.unomaha.edu/
NJ Institute of Tech	IS	IS	som.njit.edu/academics/index.php
U of North Alabama	Computer IS	CIS	www.una.edu/
U of North Florida	C IS Sciences	IS	www.unf.edu/cccec/cis/SoChtml/SoCInfoSys.07.html
Pace U	None	IS	www.pace.edu/page.cfm?doc_id=161
Quinnipiac U	Info Sys Mgmt	ISM	www.quinnipiac.edu/x496.xml
Radford U	Info Tech	IS	www.radford.edu/
Robert Morris U	CIS	ISM	sentry.rmu.edu/default.aspx
Rowan U	None	MIS	www.rowan.edu/
U Scranton	Comp Sciences	CIS	matrix.scranton.edu/academics/
Slippery Rock	Computer Sci	IS	cs.sru.edu/index.php/dept/is
U of South Alabama	C & Info Sci	IS	www.cis.usouthal.edu/
U South Carolina	Computer Sci & Engineering	BIS	hmooschool.sc.edu/moore/mgsc/mgsc-bisprog.htm
Utah S U	Computer Science	CS	www.huntsman.usu.edu/mis/
Utah Valley U	IS & Tech	IS	www.uvu.edu/
Virginia Commonwealth	IS	IS	www.isy.vcu.edu/isy/index.jsp
Wright SU	IS Oper Mgmt	IS	www.wright.edu/business/acad/isom/

TRANSFORMATION OR EXTINCTION - IT'S DECISION

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ABSTRACT

Information Technology (IT) directorates embedded in every public and private sector organization are asking, “*How do we remain relevant?*” and “*how do we keep up with our customers?*” IT’s historical role was based on thought leadership; its future role is looking more like one of testing, facilitating and organizing the thought leadership of others.

If IT fails to solve its relevance problem, the implications are enormous, catastrophic and permanent. Customers will look elsewhere for IT solutions and support. Unlike the past, customers have options. IT needs to do all it can to win customer loyalty. The solution to these problems is not found in hiring a futurist or a strategic planning consultant. Instead, we suggest the solution involves exercising customer-focused leadership.

INTRODUCTION

This article describes the IT journey over four distinct periods and why the upcoming fork in the road is a choice between transformation and extinction.

The Distant Past (1960-1980) “The Roots of the IT Business Model”.

The Recent Past (1980-2010) “The Age of the PC”.

The Present and the Four Forces shaping the Future of IT.

The Future: IT’s decision to transform or become extinct.

IT’S JOURNEY

The Distant Past (1960-1980) “The Roots of the IT Business Model”

When the authors started their careers, IT was the keeper of the mainframe computer. You entered the IT Department with a bow and handed over a stack of Fortran based punch cards. The IT professional would take the cards with a smirk, knowing full well that your Fortran program would never run the first time. You either missed a comma or had one too many. Bottom line, customers of our era were in awe of IT; IT was all-knowing and all-powerful.

We relied on IT to...

- Build a database with large storage capacity.
- Set up a project team room and networking site.

- Develop a project-specific application.
- Process complex mathematical models.
- Provide graphical and plotting tools.
- Acquire and maintain servers.
- Operate mainframe computers.
- Acquire and maintain ERP systems.

Just like in *The Wizard of Oz*, IT was the wizard behind the curtain. But there were forces at work pulling back the curtain.

The Recent Past (1980-2010) “The Age of the PC”

We all remember our first personal computer. Older readers will remember how scary that 64k machine was. We didn't know how to type and we were pretty sure we would make a mess out of this new fangled device. You had to keep telling yourself, “I can always pull the plug and start over”.

Little did we know how profoundly the PC would change what we did and how we did it. The transformation wasn't overnight; it came over us in waves. The first wave occurred when someone figured how to connect one PC with another through a LAN (local area network). Then someone else figured out how to connect PC's through phone lines, offering almost limitless connectedness. Then wireless came along, enabling cloud computing; it makes you wonder what's next.

Many traditional roles have disappeared in the wake. Secretaries became an endangered species as the administrative burden was pushed out to everyone equipped with a laptop. Just ask anyone how much time they spend dealing with administrative matters and brace yourself for the response. It's insidious and creates piles of virtual work for everyone.

Although IT remained engaged and indispensable throughout the recent past, the insular nature of their business model was starting to show through. Here are two cases where the curtain was opening.

Case #1: If we build it, the customers will come...In a recent discussion with the Director of Transformation for a very large government agency, we had to break the news that few, if any, were using their brand new portals. This news came as a shock because in the past, if IT built it, customers came. Not so anymore...

Case #2: IT and measurable business results? NASA has spent over \$1 billion on a shiny new financial management system, SAP, and has now gone seven straight years without a clean financial opinion.

The following excerpt is from the House Subcommittee Oversight Hearing to Examine the Audit of NASA's Financial Operations [4]. “*NASA received the report of Ernst & Young evaluating the Fiscal Year 2009 (FY09) financial statements on November 13, 2009 constituting a "disclaimed opinion," which means that the auditing firm finds a material weakness in the*

accounting processes of the agency so severe that they cannot reliably verify the agency's financial accounts. This is the seventh disclaimed opinion the agency has received in a row."

In August 2010, the OMB (Office of Management and Budget), stepped up to the matter of IT and weak business results by making the following decree... *"In order to justify future funding for IT projects, agencies will need to demonstrate that project risks can be reduced to acceptable levels through actions such as setting proper project scope, defining clear deliverables and mission-oriented outcomes, and putting in place a strong governance structure with explicit executive sponsorship. Projects which do not meet these criteria will not be continued."* [10]

OMB's decree moved billions of IT investment funds into suspended animation. It's amazing the OMB fails to mention a customer focus and ROI... maybe they're there between the lines. But why not say it out loud?

Based on these two cases, one starts to question IT's relevance. One unthinkable implication is that the IT organization, as we know it, might cease to exist. As IT's cost v. benefits are exposed to the light of day, it is fast becoming a financial sinkhole.

The Present and the Four Forces shaping the Future of IT

At this very moment there are four forces at work pushing and pulling at IT. These forces are reshaping IT and setting the stage for its future.

Force #1: IT Momentum

One example of IT momentum is the fact that IT still views its captive users as IT dependant. However, Mac users are showing up at work fully enabled with their MacBook Pro, iPad, iPhone, iTouch and iWhat's Next. That last sentence sounds like a quote from an Apple marketing manager but it was actually stated by Dell's senior VP at a recent federal IT conference. For example, NASA's desktop support now includes accommodation for iPhones. If IT is losing control of the employee's desktop configuration, what's next?

IT still sees itself as the keeper of the infrastructure, the server farms, where all the data resides and they raise the security flag at a moment's notice. In the past, who would have dared challenge the security risk? Now, there are some challengers who claim security is a surmountable hurdle, especially given the following fun facts about server utilization: *"Forbes estimates a rule of thumb for organizations with 5,000 servers, that 30 percent of them are technologically obsolete. That's 1,500 servers that could be unplugged with little or no impact on performance. If unplugged, those servers would represent a \$12 million to \$23 million reduction in the organization's annual cost; \$700,000 annual savings in electrical costs and a 6,000 ton reduction in greenhouse gas emissions each year."* [1]

Force #2: External Technological Push

The most talked about emerging technology is cloud computing. It's called cloud computing because the diagram (Figure 1) resembles a cloud and it operates without hard wire connections or even legal connections.



Figure 1 (Marketspaceadvisory.com)

Very much like the expression ‘black hole’ that is neither black nor a hole, Cloud Computing has nothing to do with a cloud. The name stuck because the name alone stimulates everyone’s imagination.

Unlike the brilliant marketing slogan, “Intel Inside”, found on every PC, there’s not likely a need for a cloud label, “Google Inside”, or “DELL inside” mainly because there’s no place to put the label. Just like Intel’s microprocessors, no one will see the cloud’s inner workings and, as with the microprocessor, most of us could care less what it looks like.

Cloud computing involves three fundamental concepts:

- Applications as a service, which are already here and will expand. Yahoo email is one common example. As we worked on this article, we sent the recent draft to our email as virtual backup storage. It’s your hard drive in the cloud. You may lose your Kindle, but Amazon backs up all your books. It’s your library in the cloud.
- Platform as a Service provides infrastructure for software developers to build new applications or extend existing applications without purchasing development or production servers. Salesforce.com’s Force.com, Google’s App Engine, and Microsoft’s Azure are examples.
- Infrastructure as a service. The cloud offers an elastic IT infrastructure in the same way a homeowner taps into the power company. We simply turn the rheostat for more or less energy; likewise we can simply call up more cloud-based server capacity.

“What is driving this shift to Cloud Computing is a change in perspective from seeing the computer as a box to seeing the computer as a door.” [9]

“Wikipedia is a popular example of Cloud Computing in action. Wikipedia is a user-created online encyclopedia run by a non-profit foundation that has become one of the world’s leading sources of information accessed on the web. Built and developed by more than two million

contributors around the world in multiple languages, Wikipedia represents 100 million hours of human labor.

The intelligence community uses a resource called Intellipedia. With more than 35,000 active users, the site operates on the same software as Wikipedia. Participants post more than 5,000 contributions a day to a platform that operates three networks – unclassified, classified, and top secret.” [5]

Wikipedia and Intellipedia are examples of Groupware, collaborative software designed to bring people together in a virtual cloud-based environment to solve problems and share knowledge on a particular subject. Social software, such as Facebook and Twitter, are cloud-based environments designed to share life's everyday experiences. Billions of people walk through these virtual doors everyday. *Time* put an exclamation point on one of the most famous cloud-based methodologies by naming Mark Zuckerberg, Facebook's CEO, their 2010 Person of the Year. *Time* bestows this recognition based on the winner's influence on events of the past year. Zuckerberg is now a member of an amazing club including popes, presidents, queens, kings and scientists. Coincidentally *Time* marked the beginning of the personal computer age by naming "The Computer" its 1982 Person of the year.

Microsoft is the first to bring cloud computing out of the closet with several new TV commercials featuring an actor's exclamation "to the cloud" as the way to solve almost any problem. No definition or explanation is offered, the viewer is left to imagine the what's, why's, how's and where's of "the cloud". The message is clear, cloud computing is here to stay and working its way into almost everything we do.

As you might guess there are storm clouds at work threatening to rain down on cloud computing. Most experts agree on the top three obstacles to cloud computing:

Security is the first and most cited obstacle to cloud implementation. Cloud computing in a secured environment, such as within a federal agency or credit card company, can take on various configurations. For example a NASA cloud computing environment might resemble concentric circles, with the inner circle consisting of a very localized, very secure and highly restricted internal cloud. The outer-most circle could be a wide open commercial cloud offered by Amazon or Google. Between the inner and outer clouds there might be various agency-wide, government-wide and industry-specific clouds with defined functions, boundary conditions and set of security protocols.

The second obstacle to cloud implementation is the lack of control over third party providers of cloud technology and storage. This obstacle calls into play the need for well-drafted SLAs (Service Level Agreements). Weak and loosely worded SLAs can lead to serious problems, such as unexpected down time or lost data, trapped in a third party's cloud framework.

The third obstacle is the lack of cloud standards and the problems associated with a sole source vendor.

There follow two examples of organizations that stepped into the cloud in spite of these obstacles.

Genentech is a large corporate example. *“The economics of the cloud certainly appealed to Genentech. So much so that they turned to Google Apps to meet the needs of their 16,000 strong workforce. Based on the number of Genentech employees granted Google software accounts, the South San Francisco-based biotech company is paying at least \$800,000 per year for the online Google Apps package. However, this cost is much less than what buying and maintaining a software package from Microsoft, Oracle or IBM would have run the company.”*

“Additionally, Genentech figures to save a lot more money in the long run. According to CIO, Todd Pierce, the company would have had to eventually invest up to \$80 million in building a data center and hire many more IT professionals and engineers to meet its computing needs.”[6]

In spite of security concerns, a spy agency stepped up to cloud computing as illustrated by a Fox News Headline – “Spy Agency Amends No-Bid Contract Notice, but Google still favored.” *One of 16 spy agencies reporting to the president, the National Geospatial-Intelligence Agency (NGA) provides aerial satellite imagery and mapping, as well as analyses of those products, to civilian and military officials at the other spy agencies and the Pentagon. The agency's Google contract was designed to provide the agency with an integrated system that would allow analysts from different disciplines to use the Google Earth mapping program in a way that allows for a freer exchange of data between them.”*

“They want to be able to acquire servers where they can host their data, the NGA's data,” said Kevin Pomfret, executive director of the Center for Spatial Policy and Law in Richmond, Va. “They want it to be secure, but they want it to be web-based, so that it can be easily accessed.” Others suggested the agency's contract notice reflected the inadequacy of the intelligence community's current computer systems. “This NGA no-bid contract is a cry for help,” said Tim Brown, an imagery analyst for globalsecurity.org. “They're basically saying that their classified customers from all over the intelligence agencies, including the Department of Defense, are not able to use the clunky, older systems that are all designated very, very top-secret.” [8]

Force #3: Traditional Customer Pull

Phil Crosby defined quality (1980) as “conformance to customer requirements”. Not an exciting definition and, at first glance, very easy to accomplish until you reflect on how fast “customer requirements” change. Every new digital innovation changes the customer's requirements. Customers simply can't get enough. Technology suppliers have to hit a moving target and that target is moving at a breathtaking pace in almost every direction. Apple's iPhone 4 is a case in point. Everyone already has a cell phone, right? So what's the big deal about a new cell phone? Yet customers swarmed Apple and AT&T stores like a scene out of the movie *Piranha*. Apple's web site announces the iPhone 4 with four words, “this changes everything, again!”

Factors shaping customer requirements are part of an extremely complex web of personal experiences, TV commercials, peer pressure and, in some cases, a cult following. Since when do corporate press conferences warrant tuning in? When Apple's Steve Jobs speaks, people tune in.

Force #4: Emerging and Unbelievably Youthful Customer Pull

The following table recaps an interview with two young technology consumers and future IT customers.

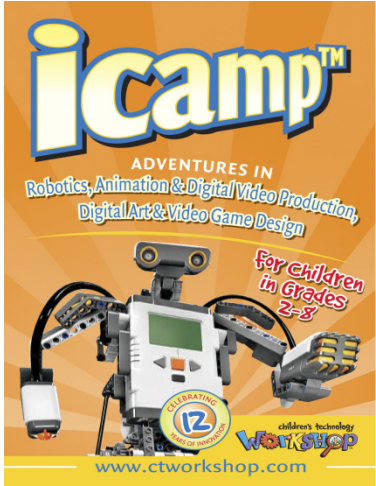
Interview Questions	Tyler [2] 13 year old boy	Jada [3] 11 year old girl
What technologies do you use?	<ul style="list-style-type: none"> - Cell phone with a touch screen and internet access. - Toshiba Lap Top that's about 1 year old with high-speed internet access. - iPod Touch with internet access. - Play station portable with internet access and lots of game systems. 	<ul style="list-style-type: none"> - Cell phone with internet access - iPod Touch with internet access. - My family's PC - Netflix - X Box
What's most important to you about these technologies?	<ul style="list-style-type: none"> - #1 is texting. - #2 is phone calls. - Internet and access to Google, You Tube, Yahoo email, video games. - I also have about 30 apps. - It has to be free or at least cheap. 	<ul style="list-style-type: none"> - #1 is phone calls. - #2 is texting. - Email. - Game apps. - Google. - It has to be cheap.
Who comes to mind when you want what's next?	Only Apple; no one else comes to mind.	Only Apple; well, maybe Nintendo
How do you find out about the latest things?	Radio and TV ads	My friend Tyler and TV commercials. Some games have commercials.
Where do you go to get a question answered?	Google	My dad and Google
Where do you go to figure out how to solve a technical problem?	Myself	Tyler, my dad and then back to where I bought it.
What is Facebook to you?	Facebook is not allowed; I think of Facebook as a cyber-bullying medium.	I'm on Facebook and use it to communicate with friends and for the games.
How important is texting to you?	Extremely! It's how I communicate	Not very, I prefer to call my friends.

Interview Questions	Tyler [2] 13 year old boy	Jada [3] 11 year old girl
Which apps do you use most and why?	#1 Entertainment and game apps #2 Business and stocks – mutual funds – I do research and consult with my dad before I buy or sell.	#1 Game apps #2 Interesting, unique apps.
What do you think will be the next big technology?	Cell phones with holograms and 3D images.	Next generation phone
Unsolicited comments	My motto is, if you can't afford it; don't buy it!	

As you can see, IT is part of the fabric of Jada and Tyler's lives. It's how they communicate, how they stay up to date, how they answer questions and how they entertain themselves. They expect IT power that's easy to use, accessible and free. When asked about the NASA apps, their first question was, is it free? They need to be continuously connected. It wasn't too long ago the transistor AM radio represented our wireless, connected world.

Jada and Tyler are young, self taught IT customers, but with very little effort they can receive even more direction and structure. For example, there are two camps that offer workshops for youths: www.internaldrive.com for kids between the ages 7 and 17; www.ctworkshop.com for kids from 2nd through the 8th grades

Both camps share the same mission – challenge young people to learn about and apply leading edge IT tools. These kids walk away able to ... (Sample brochure from CT Workshop)

<ul style="list-style-type: none"> - Create iPhone apps. - Create Facebook apps. - Do engineering and robotics. - Design video games. - Design and build interactive games. - Apply animation to digital video production. - Apply graphic design and digital art. - Carry out audio engineering. - Produce and edit films and videos. - Build 3D models. - Create an animation studio. - Apply C++ and Java programming languages. - Design web sites. 	
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At their age, the authors were learning how to throw a curve ball. In many ways these kids are too only their target is the IT organization, not home plate.

At a recent IT conference, the speaker said innovation is much less about creating new technology than it is about the application of the technology. These kids, IT's future customers, are the poster children for innovation; they're all about applying leading edge technology!

The Future: IT's decision to transform or become extinct

IT is approaching a fork in the road where one path, although smooth and familiar, is headed for a cliff. The transformational path is fog covered and uncharted territory.

The Extinction scenario: Today's customers, of any age, do not live in fear of the power wielded by IT. There's no wizard behind the curtain. Quite the opposite, today's customers may perceive the IT professional as in the way, an unnecessary middleman standing between them and getting the job done.

Tyler and Jada would never wait for an IT work order to get the functionality they need and would refuse to pay what it would cost. Those expectations foretell extinction. The future is, quite simply, millions of IT enabled and IT savvy users who don't need the wizard anymore.

We've all heard about the giant meteor that struck the Earth, marking the beginning of the dinosaurs' extinction. Could a gentle cloud be drifting toward earth with the same consequences for IT?

The Transformation scenario: Unlike the dinosaurs, IT can map out a strategy for an alternate outcome. The following are the top 5 actions IT might take to become relevant again, to transform.

1. Create a customer-centered culture by listening very closely to the Voice of the Customer. Replace the "all knowing" IT professional culture with a culture that respects and values customer feedback.
2. Rethink IT's mission from one of omniscient designer to one of integrator or facilitator, willing to serve customer requirements. As described above, innovation is the application of technology. IT should be at the forefront in innovation and must find a way to engage the customer as a rich source of innovation. How do you collect, filter and harness that rich resource?
3. Perform an enterprise-wide diagnostic of systems, processes, facilities, server farms... What's relevant and useful; what's not? What do we need to own and what can we send to the cloud?
4. Think ROI (Return on Investment). By 2015, new IT revenue generation will determine the annual compensation of most new Global 200 CIOs. [7]

5. Conduct a roles-based business impact analysis. Which IT roles focus inward and which face outward, toward the customer? Ask two questions about every inward focusing role: Do we need it? If yes, how do we redirect at least part of its focus outward, toward the customer?

The bottom line is we need to put the word customer back into the IT lexicon. Every IT professional must become passionate about customer service, customer feedback, customer partnership and the customer's success. IT will become inevitably smaller in a cloud-based future, but it can avoid extinction through transformational change.

SUMMARY

Transformational change is not for the faint of heart; it takes leadership at every level to ensure success. History has shown it's almost impossible for an organization to transform on its own primarily because its leadership team is part of the problem. To execute a transformation, an organization needs expert advice and executive coaching along the way. The good news is that the most successful transformational change occurs when there's a clearly visible burning platform. Your survival depends on change. The bad news is the fire has started for IT and many, many companies are fanning the flames.

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Is It Time To Rethink The Office Application Knowledge Requirement For Business Students?

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Abstract

At many colleges and universities, one of the core requirements for undergraduate students is to either pass a knowledge-based test on a set of functions of a popular set of office applications, usually the current version of Microsoft Office, or take a class covering those applications. New technologies, such as netbooks, and the availability of other office applications with similar capabilities have the potential of changing this model and in turn may provide an option for business schools to reduce costs associated with the operation of some of their existing computer labs.

Higher education is facing the prospect of reduced budgets over the next few years while still trying to maintain quality-learning experiences for their students. This has forced school leaders to look for areas where they can either cut or reduce expenditures over the next few years. One of the areas that is usually considered for budget cuts is the support for existing and new technologies used to support educational process.

This paper poses the question, “should schools, specifically schools of business, expect their students to be proficient in the use of a specific office suite, or should students be expected to have knowledge of set of general concepts that can be used across different office suites or applications to accomplish the same outcome?”

Introduction

The economic downturn that started in late 2008, has caused higher education to face unprecedented reductions in financial support. (Raths 2008; Perry 2009; Johnson 2009; Cornett 2009) This has placed pressure on school leaders to find ways to control or reduce the costs associated with their school's operations. One of the areas that they have targeted on some campuses has been the operation and support of the information technology, such as computer labs that are used by the students. The direct and indirect costs associated with the operation of these labs can be high, especially when the hardware and software have to be replaced or upgraded every few years due to advances in new technology.

Many business schools require students to either take an introductory course on the use of a set of business applications contained in a popular office suite or pass a knowledge-based competency examination on using those applications. These applications usually include a text processor, a spreadsheet, and a presentation tool. In most business schools, the office suite is the current version of Microsoft's Office Suite.

This paper proposes that as reduced operating budgets force schools to reevaluate various operating costs, specifically those associated with the operation and maintenance of computer labs, those schools should also consider evaluating the continued need for computer labs. As part of this evaluation, it is proposed that an analysis also be done to determine the need for undergraduate students to have knowledge on the use of a specific set of applications in a specific office suite.

Discussion

As we have already stated, the economic downturn that started in 2008, has placed financial pressures on the leaders of many colleges and universities to find ways to control or reduce operating costs, specifically as they relate to the computer teaching lab operations. Complicating this budgetary situation

is that the most software vendors usually release a new version of their office suites and operating systems every few years. In most cases, these new releases provide functionalities or options that are not needed by students to complete assignments for the courses they take.

Every educational institution should ensure that students are sufficiently prepared to meet the needs and expectations of the twenty-first-century college, career, and civic environments. Yet technology has seeped into a number of areas of the curriculum from a number of sources without, in some cases, school-wide consensus on goals, methods, or responsibilities. (Allen 2007) Technology use has evolved over the past few decades.

An example of this is the use of wireless technologies. Most campuses now provide wireless Internet access to the members of their campus communities, some campus leaders are beginning to ask “what is the point of running a computer lab when all the students already have access to their own computer anyway?” (Anderson 2009) This is because computer ownership rates of incoming freshman at most schools has topped 90 percent in recent years. According to a recent article in Arstechnica (Anderson 2009), because of this access to computers by students, a number of schools have concluded that it is time to phase out or dismantle the community (open) computer labs.

One of those schools is the University of Virginia. They conducted a survey in the fall of 2008 revealed that 99 percent of the new students on their campus brought their own laptops to the campus. While the school’s computer labs were still being heavily used (students at UV spent 651,900 hours in the labs in 2008), they found that that 95 percent of the time those students used the lab computers to surf the Internet, or to read or compose text documents, tasks that some campus officials at UV concluded the students could easily do using their own computers. Based on their findings, in 2009, UV started a three-year project to phase out all of its public computer labs in an effort to cut costs. (Anonymous-1 2009)

Issues facing Schools of Business

The authors of this paper had a number of discussions with university administrators, business school faculty and students, and business leaders in the authors’ community. Based on these discussions, the authors have compiled the following list of problems the found are facing business schools over the next few years.

1. Reduced operating budgets will make it difficult to regularly upgrade and maintain student computer labs so those computers have the newest version of the operating system, office suite (and other applications), and hardware configuration necessary to support the applications running on them.
2. The preferred hardware or operating system of some students may not match what is available to them in the computer labs. (i.e. OSX or Linux verses Windows)
3. Controlling the spread of malware continues to be a problem in student computer labs.
4. Some businesses have decided to postpone replacing their existing hardware or upgrade applications, including office suites, due to limited budgets and reduced internal technical support.
5. Some students have moved from using desktops as their primary computer to laptops, netbooks, or even tablet computers, which may not be running similar applications with what is being used in their courses.
6. As software vendors release new versions of their office applications, support for prior versions of the application may be phased out.
7. A version of an application (version X) might be the current version when a student takes the office systems class. However, version X+1 might be the current version when they graduate, but when they go to work their employer is using version X-1.

Defining Office Suite

For the purpose of this discussion, we are defining the term “Office Suite” is being a collection of office productivity programs intended to be used by typical clerical and knowledge workers. These suites usually include a text processor, a spreadsheet application, and a presentation application. Some office suites may also include a database management application. These suites include MicroSoft’s Office

(Windows and Mac), Apple's iWork (Mac), and OpenOffice (Windows, Mac, and Linux). The authors recognize there are other office suites and individual applications that are available. These include, but are not limited to Sun's StarOffice and IBM's Lotus Symphony, which are based on the OpenOffice office suite, WordPerfect Office, Lotus SmartSuite and online web-based office applications such as GOOGLE Docs/Apps and MicroSoft's announced Office Live.

Problems with current training Model

Most business schools require their students to have a functional knowledge of how to use a set of applications contained in one of the popular office suites. This is usually accomplished by either requiring a student to successfully pass a class on the use of those applications or the student is required to pass a competency exam based on using those specific applications.

The authors had a series of discussions with university administrators, business school faculty and students, and business leaders in the authors' community. From these discussions, the authors have compiled the following list of problems they feel are facing business schools over the next few years as related to the use of a specific technology a course.

1. Some textbook publishers provide computer-based simulators for a specific office suite to go along with their textbook/manual. Having to use a simulation sometimes limits the way a student has to complete some of the required tasks. These tasks may require the use of a drop down menu rather than a set of hot keys or other options that the student may already be proficient in using.
2. To complete their course assignments, some students may be required to learn and use a different office application that they do not have access to outside of the computer lab.
3. Many of the available office suites have functions or capabilities that most business students will never need to use to complete assignments for their courses.
4. Students who already possess the knowledge of how to use one or more of the office applications may have difficulty working within a simulated environment of the application. This is because the simulation may force the student to actually work at a slower pace or speed, increasing their frustration and possibly increasing their rate of errors.
5. Students already possessing the required basic application knowledge might actually be at a disadvantage in the course if they are already proficient of a different version of the application or a different one than the one being used in the course.
6. Files created by a student using a prior version of an application might not be compatible with a newer version of the same application. If the file is created in the lab, the new file might not be backwards compatible with an older version of the same application the student has access to on their personal machine. This makes it difficult for some students to work on the same assignment, both on and off campus.
7. The current learning model has the potential of penalizing students who choose to not work in Microsoft's Windows or Office environments.
8. Some faculty members may not be using or have access to the same version of the office suite application the students are using in the computer lab to complete their class assignments.
9. Commercially produced course materials for prior versions of some office suites may not be available after the publisher releases the new course material for the newest version of an office suite.
10. While some textbook publishers offer textbook/application packages that include a limited-use licensed copy of the office suite covered in the text, it may not be a student's preferred office suite application. In addition, some students may not be able to run it on their personal computer due to various incompatibilities (hardware, operating system, available disk space, memory capacity, etc.)

Acceptance of new computing technologies by students and businesses

At one time, the parents of new college students were told to buy for them most powerful computer that they could afford in hopes that the computer would have enough capacity to meet the needs of their child through their college career. However it has been found that most of the time students only use their computer for most common tasks—email, Web surfing, watching streamed videos—applications that

require very little processing power. (Thompson 2009) This means the traditional model of new students having the most powerful computers might no longer be a valid.

In some cases students are opting for netbooks, which are small notebooks. Their smaller size and capabilities are starting to change the way that some people are viewing computers. Most netbooks are capable of running most web browsers and office suites. Thompson (2009) reported that netbooks have become to be so cheap, they're reshaping the fundamental economics of the PC business.

Businesses are facing similar financial problems as colleges and universities. Due to this a growing number of businesses have started to use open source applications, including those on the desktop (Schindler 2008). Most of these alternative office suites are now capable of opening or saving work in formats used by other popular office suite applications. While in some cases these may not 100% compatible, in general the file conversions work for nearly all of the basic tasks. (Montalbano 2008, Chitu 2009)

Cloud Computing and office applications

A new type of computing model has entered the office applications picture. It is called "cloud computing." The term "cloud computing" is being used to describe the growing number of web-based applications or Internet-based services. There are various benefits and problems to using applications that are available via this Internet "cloud." At this point-in-time, these may not be a perfect substitute for some desktop applications. However, cloud computing can theoretically replace a number of things normally done by software running on a user's machine. The first and most obvious use is with office suites. (Ingram 2008)

Cloud computing-based office applications have already started changing how businesses and individuals access, use, and distribute data and information. A growing number of individuals and organizations are beginning to use these cloud-based office applications, such as Google Docs and Zoho suite, as their primary text processor, spreadsheet, and in some cases, presentation development tools. (Ingram 2008) Microsoft has also announced a cloud-based version of their office suite called "Office Live" (Fabre 2008). Many of these, including as GOOGLE's DOCs, are available at no cost to the users. The key thing about online applications is that they are platform-agnostic. Therefore as cloud-based application such as Google Docs works just as well on a Windows PC as it does on a Mac or a Linux box. (Thomas 2009)

The latest version of IBM's Symphony now supports Office 2007 file types (.docx, .xlsx, .pptx, and the like), so any company that's used Microsoft in the past would retain access to all their old files, which IBM is pushing as a major selling point. Symphony also has animations that can be merged into PowerPoint presentations. (Vernon 2009) In fact, in the fall of 2009, IBM's 360,000 employees were told that they needed to switch to Symphony. The decision, in affect, made the Open Document Format (ODF) the preferred document format at IBM. (Wuelfing 2009)

To control technology costs, some public school systems have decided to delay upgrading the computers in their classrooms. Some are opting to use one of the open source options such as OpenOffice. These school systems also are encouraging their teachers to use OpenOffice on their home computers. This would indicate that many graduates of high schools within these school districts would have at a minimum been exposed to OpenOffice. Some of these districts also use older versions of other office suites such as Microsoft Office suite due to hardware limitations, textbook replacement cycles, or lack of funds to upgrade to the newer version.

One of the benefits of cloud-based office applications is the ability of real-time electronic collaboration. Student collaboration on class assignments and projects has become an important component aspect of many business courses. Cloud-based office suite applications are capable of facilitating this type of online collaboration. They allow students who are working on joint projects to access the same document, spreadsheet, or presentation without having to be physically at the same location. Cloud-based office applications also have the potential of adding new dimensions for providing students with training in using an application that permits them to work on documents in a real-time online collaborative environment.

However, one of the biggest problems with students using cloud-based or Internet-based applications in general is that some students, who live in very rural areas, might only have dial-up Internet access. These students would be better off using a computer-based office application to complete their class assignments.

PROPOSAL: Teaching office concepts instead of specific applications

Given the above discussions, the authors propose that business schools and textbook publishers consider moving away from the model where they require their students to be proficient in a specific suite of office applications and look to adopt a model where their students can complete a series of tasks using applications in any office suite the student has knowledge enough to use.

Business schools should survey the members of their faculty to determine what technical skills they feel students should have for each type of application to be successful in their courses. The technical skill requirements for the core business classes should be specifically noted. Based on the information collected, schools should develop a series of skill-based tasks for each of the applications. Rather than require students to learn applications contained in a specific version of an office suite, schools should develop lists of technical skills in the use of the primary office suite applications (text, spreadsheet, and presentation) office business students should poses in order to be successful in their core classes and in their careers after graduation.

Business Schools should also work with the potential employers in their area who normally hire graduates of the school to develop a list of office application skills they feel students should have at the time of graduation.

Finally, business schools will need to work together with their advisory groups to develop a series of competency exams. These exams should be based on basic-knowledge of how to complete a series of tasks using an application in a non-specific office suite rather than an exam based on completing a series of tasks using a specific office suite or application(s) within a specific office suite.

Obstacles that may have to be overcome

Based on the authors' discussions with the groups previously mentioned, we have compiled the following list of obstacles that would have to be overcome or at least consider if students were required to learn office suite concepts instead of learning a specific office suite.

1. The review and grading of student's assignments may be complicated due to the possibility of students using a different version of the office suite application than the one being used by the instructor.
2. If students are permitted to use different versions of an office suite, there is the need for the creation of generic verses specific bank of competency test questions.
3. The authors could not find course materials that could be used for a generic course on office applications in a non-specific office suite. One would have to be developed in-house or by one of the textbook publishers.
4. While Windows-based computers have dominated most business school computer labs, other operating systems are being accepted and used by students and enterprises. These include OSX (Apple) and Linux (such as UBUNTU). There are comparable office suites for each of these.

Conclusions

Business schools should consider adopting a learning model that requires conceptual-based knowledge of a text processor, a spreadsheet, and a presentation tool. Establish that students can use any office application to complete a class assignment. However it should also be established that the campus technology support offices will only provide support for a specific and limited number of those applications.

Business programs need to be able to adapt faster to changes in technology. New technologies continue to reshape how individuals and businesses use, distribute, and share information. In some cases, students may be ahead of the curve. Business students and faculty need to understand how the existing and evolving technologies can be used to solve existing or evolving business problems. Many students are already proficient the use of computers through their use of Twitter and Facebook, and have used some form of office suite since elementary school.

New versions of most computer applications tend to be more complex, inquiring larger amounts of system resources (storage space, processing power, and memory). This means that in a campus computer lab environment, the costs associated with installing the latest version of an Office Suite (or other large application) on all the computers in the lab, may also require upgrading or even replacing all the computers in the lab if they do not have the capacity to reasonably run the applications. As has been recognized by the University of Virginia and other schools, this can become an expensive situation. An expense some schools may no longer be able to afford.

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Just What the Doctor Ordered?
A Case Study of RFID Implementation in a US Hospital

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Abstract

IT implementations, especially RFID, can often produce shifts in the balance of power between groups in an organization, giving greater control to one group while reducing the control of another group. This can be especially true when RFID is used to monitor the movement or actions of individuals. A few studies (e.g. Kohli and Kettinger, 2004; Lapointe and Rivard, 2005) have looked at the resistant response of physicians to information systems that they feel threatened their autonomy; but as Lapointe and Rivard (2005) note, there is a need to examine the reaction of nurses in similar situations.

Keywords: new technology implementation, healthcare, resistance

I. Introduction

Radio frequency identification (RFID) systems are used to identify or track objects and people using wireless transmission. An RFID system is made up of an RFID tag (or transponder) which is affixed to the item being tracked and a reader (or interrogator) (Xiao, et al., 2006). RFID is being used in an increasing number of applications throughout a wide range of industries, one of which is health care. While the benefits of RFID technology can be high, the potential problems associated with its use in this setting are many. In fact, a 2006 survey by BearingPoint found that only 10% of US hospitals had implemented an RFID system (BearingPoint, 2006). The unique characteristics of this industry (such as high employee bargaining power, a strong need for customer privacy, and high governmental regulation) make implementation difficult for a technology that is designed to put previously unobservable information in the hands of management.

We use the ethical principle of distributive justice, which says that the outcomes of an action should be distributed fairly among stakeholders, to argue for the reorganization of work practices and procedures in order to provide all workers a share of the anticipated benefits (Schminke, et al., 1997). Using Ba, et al.'s (2001) suggestion of incentive alignment, we

hypothesize that when trying to obtain buy-in from a powerful constituency (in this case nurses) over which the sponsors of the project (in this case the Information Systems Department) do not have direct control, it can be useful to adjust work procedures and incentive in order to align the goals of resistant users with those of the organization.

In this study, we look at the implementation of and subsequent employee reaction to an RFID pilot project at a large, publically-owned metropolitan hospital in the southeastern US. The hospital in this project is a member of one of the largest healthcare systems in the country. It is a teaching hospital with over 800 beds and has won a number of awards for excellence in different specialties. Because of its status within its healthcare system, this hospital often is one of the first to receive new technology and serves as a testing facility before new technology is rolled out to the other hospitals in the organization.

This paper is ordered as follows. First, we discuss some of the unique characteristics of healthcare organizations. Second, we present a brief discussion of technology implementation and innovation adoption in healthcare organizations. We then use these theories to examine the implementation of RFID at ABC Hospital and to produce suggestions on how ABC can reduce resistant behavior among the nursing staff.

II. Technology Implementation and Innovation Adoption in Healthcare

A. Characteristics of Healthcare Organizations

While many of the studies that have been done on RFID implementation have looked at the manufacturing setting or organizations in general (Karkkainen, 2003; Smith, 2005; Kelly, 2005), we look at RFID implementation in the healthcare industry. The healthcare industry has a number of characteristics that differentiate it from most other industries; among the most important of these differences are high employee bargaining power, a strong need for customer privacy, and high governmental regulation.

Healthcare organizations can be broken down into two categories: publically-owned, non-profit institutions and commercially owned, for-profit businesses. Because privately-owned hospitals on average have larger profit margins, they are often able to invest more in technology than their publically-owned counterparts. In fact, in their study of the management practices of publically owned and privately-owned hospitals, Schlesinger, et al. (1987) found a consistent influence of ownership on the operations of healthcare organizations. Much of the difference in profit margins between the two can be explained by their respective economic models. In addition, healthcare organizations are subject to a number of laws and regulations that don't affect most other industries.

One of the most well-known and stringent of these laws is known as the Health Insurance Portability & Accountability Act of 1996 (HIPAA). HIPAA is a collection of laws created by congress to standardize the interchange of electronic data among healthcare organizations and to ensure the security and privacy of electronic health records. Specifically, HIPAA required the Department of Health and Human Services (HHS) to create a standard format for health information exchange; to create unique identifiers for patients, health care providers, health plans, and employers; and to protect the integrity and confidentiality of "individually identifiable health information" (Phoenix Health Systems, 2005). Because of the stringent requirements of HIPAA when dealing with patient data, hospitals must be very careful when transmitting any patient identifiable information, including that generated by an RFID system.

Another major difference between healthcare organizations and other organizations is the relative power of its different stake holders. Kohli and Kettinger (2004) detailed the difficulties a hospital encountered when implementing an IT application against the wishes of many of its physicians. The authority of a hospital over its physicians can vary from facility to facility and even from doctor to doctor. Physicians can either be employed directly by the hospital or be self-employed and have admitting privileges at the hospital. In either case, hospitals often have very little authority over the treatment decisions or technology usage of the physician. In situations

like this, group members are often influenced by colleagues instead of by management. To improve acceptance of a technology in a situation where the principal of the project does not have direct control over the proposed users of a system, Kohli and Kettinger (2004) suggest that the principal should attempt to improve the perceived accuracy of the information, provide a customized user interface, enroll the support of influential staff and other clan members, and create an environment where the technology is incorporated into normal work processes.

Although the Kohli and Kettinger (2004) study dealt with the power of physicians, nurses too can also wield quite a bit of power in the hospital setting. The role of nurses in the US has evolved from simply being a doctor's assistant to being a primary care provider for many patients. Many of the tasks once handled by nurses, such as bathing patients and changing bedpans, are now handled by nursing assistants. The US is currently facing a nursing shortage with hospitals and other healthcare facilities competing for a limited supply of skilled nursing labor. This provides hospitals an incentive to treat their nurses well. Patients and insurance companies also wield considerable power in the hospital setting. Patients have the right to refuse most any procedure unless ordered by a court, while insurance companies can refuse to pay for procedures they view as experimental or unwarranted. Hospital management must proceed carefully when making decisions that might upset any of these constituencies.

B. Implementation of New Technology by Healthcare Organizations

To implement a new technology in an organization, two distinct groups must make a choice to accept the technology and the changes in processes that come with it. First, the management of the organization must identify a technology that meets an organizational need and install it within the company. Second, the employees who work with the technology must choose to work with it. Getting employees to adopt new technology is not always easy, especially if the employee does not observe a need for or benefits from the technology. This problem can be made even more difficult if management does not have a strong bargaining position relative to the

employee as is sometimes the case in the healthcare setting. A good example of this situation is presented in “Informing the Clan” (Kohli and Kettinger, 2004) where some physicians were in open rebellion against a physician profiling system that they felt interfered with their autonomy.

Implementing new technology can also be expensive, especially for publically owned healthcare organizations such as ABC Hospital where budgets are tight. Many implementations will not be funded if they do not present a clear return on investment. Poon, et al. (2006) found that among the healthcare organizations surveyed, the number of information systems projects that focused on financial benefits far exceeded those concerned with patient safety and care quality benefits. They also found that many healthcare organizations face major financial hurdles to adopting new technology, which could be the reason that most projects focused on cost savings.

Recent research has found a number of interesting trends concerning technology adoption in healthcare organizations. Table 1 contains a list of selected research on IT implementation and adoption in the healthcare environment. Karsh and Holden (2006) argue that the state of continuous technological change that exists in many healthcare organizations today may cause more harm than good if organizations don’t follow IT implementation strategies based on scientific guidelines. Drawing from a literature review of a number of implementation studies, they identified four organizational factors that they believe are important for a successful implementation: organizational support, training, voluntariness, and end user participation. They also indentify the social/cultural factors of social influence and group differences as being important. These results indicate that implementation of new technology in the healthcare setting is not just about buying a software package, but about working with the users of the system to make sure they are prepared for the change and that their needs are met. Hu, et al. (2002) proposed and tested a model for healthcare organizations’ adoption of telemedicine technology. Their research found that the opinion of medical staff was one of the most significant factors in whether or not an organizational adopted telemedicine technology. This would suggest that

healthcare organizations highly value the opinions of their staff on new technology that does not threaten patient care.

One theory that links user-perceived benefits that an IT system provides to the successful adoption of that system is known as the Technology Adoption Model (TAM, TAM2) (Davis, 1989; Venkatesh and Davis, 2000). Based on the Theory of Reasoned Action (TRA), TAM suggests that an individual's use of a new technology is based on that person's perceived usefulness and perceived ease-of-use of the new technology. Davis defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance". He defined perceived ease-of-use as "the degree to which a person believes that using a particular system would be free from effort". TAM can be very useful in helping researchers understand resistance to new technology by individuals in the organization. Wixom and Todd (2005) also proposed and validated a model that tied together the concepts of user satisfaction and technology acceptance. They found that user satisfaction with the system does influence technology acceptance. To obtain a more favorable adoption response from employees and to discourage resistance, Ba, et al. (2001) discusses the need for proper incentive alignment in addition to proper system design when implementing new information systems to make sure that the organizational incentive structure supports system use that is consistent with organizational goals. This incentive structure could include both economic (e.g. bonuses or prizes) and social incentives (e.g. recognition).

Table 1 – Selected Research on IT Implementation and Adoption in Healthcare

Study	Subject of Study	Findings
Ash, et al., 2001	Physicians	Identified four themes that impact diffusion of innovation: organizational issues; clinical and professional issues; technology implementation issues; and issues related to the organization of information and knowledge.
Berg, 2001	Healthcare Organizations	To successfully implement a patient care information system, changes must be made in both the organization and the technology, with each transforming the other. To succeed, this process must have the support of both users and management.

Chau and Hu, 2001	Physicians	This study compares the effectiveness of the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and a decomposed TPB model to predict a physician's adoption of telemedicine. The findings suggest that perceived usefulness of a technology was more important than its ease of use for physicians. The physicians studied also considered technology-practice compatibility to be very important, but did not consider the opinions from relevant others in their adoption decision.
Chau and Hu, 2002a	Physicians	Physicians tend to base their acceptance on an information system's usefulness rather than its ease of use. In addition, physicians appeared to be very concerned about the compatibility of new technology with existing practices and placed little value on the opinion of peers concerning the technology.
Chau and Hu, 2002b	Physicians	This study compared TAM and TPB and found that TAM may be more accurate than TPB for examining technology acceptance by physicians.
Chau and Hu, 2004	Physicians	This study found that a clinical administrator can have a significant impact over a physician's decision to adopt telemedicine and a consensus on the technology must be reached by physicians early in the implementation process in order to have a successful implementation.
Dixon, 1999	Healthcare Workers	Proposed a model that included requirements, capabilities, fit, perceived usefulness, and perceived ease of use to predict adoption.
Gagnon, 2003	Physicians	This study found that perceived social and professional responsibilities strongly predicted the adoption of telehealth technology by physicians.
Heathfield, et al., 1998	Physicians	This paper calls for the development of multi-perspective evaluations of clinical information technologies that integrate quantitative and qualitative methods to aid physicians in their evaluation of a particular information technology.
Hu and Chau, 1999	Physicians	This study found that attitude and perceived behavioral control are the strongest predictors of physician telemedicine technology acceptance.
Hu, et al., 1999	Physicians	The study found that TAM was somewhat able to predict physicians' intention to use telemedicine technology. It also found that perceived usefulness was a significant determinant of attitude and intention and that perceived ease of use was not a significant determinant of either attitude or intention.
Hu, et al., 2002	Physicians	This study found that the opinion of medical staff and perceived service risks were the most significant determinants of telemedicine technology adoption.
Karsh and Holden, 2006	Healthcare Organizations	The state of continuous technological change that exists in many healthcare organizations today may cause more harm than good if organizations don't follow IT implementation strategies based on scientific guidelines.
Kohli and Kettinger, 2004	Physicians	The study found that to improve acceptance of a technology in a situation where the principal of the project does not have direct control over the proposed users of a system, the principal should attempt to improve the perceived accuracy of the information, provide a customized user interface, enroll the support of influential staff and other clan members, and create an environment where the technology is incorporated into normal work processes.
Lapointe and Rivard, 2005	Physicians	This study created a model of escalating resistance to IT implementation based on three case studies that looked at physicians' resistance to new IT implementations in the healthcare setting. The authors note that the resistance behavior of nurses has not been studied and suggest it for a future research topic.
Poon, et al., 2006	Healthcare Organizations	This study found that healthcare organizations were more likely to adopt new technology that provided financial benefits than technology with

		quality and safety benefits. They also found that many healthcare organizations face major financial hurdles to adopting new technology, which could be the reason that most projects focused on cost savings.
Yi, et al., 2006	Physicians	Proposed and found support for a model that included result demonstrability, perceived ease of use, personal innovativeness in IT, perceived usefulness, perceived behavioral control, and subjective norms to predict adoption intention in physicians.

C. Resistance to New Technology

Occasionally, users will display resistance to new IT implementations for a variety of reason. Reasons for this resistance can include perceived costs being higher than perceived benefits (Keen, 1981), detrimental changes in the balance of power versus others (DeSanctis and Courtney, 1983; Joshi, 1991; Ang and Pavri, 1994), or the uncertainty and stress that change brings with it (Marakas and Hornik, 1996; Lee and Clark, 1996-1997). To truly be convinced that the change is necessary, the employee must first perceive a need that outweighs any perceived negative consequences of the new technology. If the employees affected negatively by the change are not the employees who will be affected positively by the change, it will be difficult to convince them to make the sacrifice. This most likely will violate their sense of distributive justice (Schminke, et al., 1997).

Markus (1983) examined three theorized sources of end user resistance: personal issues of end users, poor system design, and problems with the interaction of the system and the organization. She found that all are possible sources of end user resistance, but that they must be dealt with in different ways. Lapointe and Rivard (2005) created a model of escalating resistance to IT implementation based on three case studies that looked at physicians' resistance to new IT implementations in the healthcare setting. According to Lapointe and Rivard (2005), at installation, users will assess the system to make judgments about the consequences of the system. If the users feel threatened by these consequences, then resistance behaviors will result. If users believe a shift in the balance of power between the users and other user groups is occurring because of the new system, the object of the users' resistance can change from the

system itself to the significance of the system. Alternatively, if users believe a shift in the balance of power between them and the system advocates is occurring, the object of the users' resistance can change from system significance to the system advocates. If the user feels threatened by the object of resistance (the new system), resistance behavior can occur.

Although both physicians and nurses work in the healthcare environment, it should not be assumed that they will both react the same way to new IT implementations. As mentioned earlier, whether physicians work for the hospital as an employee or with the hospital as a sole-proprietor, they still wield considerable power in most healthcare organizations. Nurses, on the other hand, usually work directly for the organization and generally do not have as much power as physicians do. However, with a shortage of nurses in the US and the increasingly important role that nurses play in healthcare delivery, nurses do have a good deal of influence in most organizations.

III. RFID Implementation at ABC Hospital

A. Project Description

An RFID implementation project was studied at a large, publically-owned metropolitan hospital in the southeastern US. We will call this hospital ABC Hospital. ABC Hospital is a member of one of the largest healthcare systems in the country. It is a teaching hospital with over 800 beds and has won a number of awards for excellence in different specialties. Because of its status within its healthcare organization, ABC often is one of the first to receive new technology and serves as a testing facility before it is rolled out to the hospitals in the organization. The project manager for the RFID projects agreed to meet with the author a number of times during the implementation to share his experiences from the process.

RFID technology generally falls into one of two categories: passive or active RFID. While both technologies are referred to as RFID, they are actually quite different. Passive RFID

uses RF energy sent from the reader to power the tag. The passive RFID tag will either reflect this energy back to the reader or store up a small amount of the energy to power a quick response to the reader. Passive RFID tags can also contain a small amount of storage (approximately 128 bytes) that allows each tag to contain identifying information. Active RFID technology uses a powered reader to transmit information to the tag. Because active RFID tags are powered by a battery, they are necessarily larger than passive RFID tags. Active RFID tags can also store more information (approximately 128 kilobytes or more) (Savi Technology, 2002). Although there is a small-scale implementation of passive RFID technology at the hospital, the focus of this study will be active RFID technology.

This pilot project was undertaken by ABC Hospital in order to determine if an RFID system can provide business value to ABC in either return on investment or improvements in operational functions. The IS Department is also interested in testing the technical scalability and functional viability of the RFID system. ABC's IS Department hopes to discover additional uses for the RFID technology during the course of this project. The RFID technology used in the project consists of active RFID tags that will communicate over ABC's existing 802.11g wireless network and utilize software from an RFID technology vendor. In order to implement this project, all areas of the hospital campus had to be "mapped" using digital copies of ABC's floor diagrams and software provided by the vendor. Every room of the roughly 1.7 million square foot facility was visited by a technician with a laptop computer that could record the technician's current location as well as readings of signal strength at that location from different wireless network access points. An RFID tag's position could then be determined by triangulation using the relative signal strength of at least three wireless access points.

RFID tags have been placed on a number of different types of equipment including ventilators, IV pumps, and non-invasive blood pressure monitors. These machines are used by nursing staff throughout the hospital. IV pumps may even accompany a patient to another facility if it is still in use when the patient is transferred.

The project is sponsored by Information Services (IS) Department. The Clinical Engineering Group (CEG), which is a part of the IS Department, is responsible for the maintenance of all of these machines (ventilators, IV pumps, and non-invasive blood pressure monitors), while the Sterile Processing Group (SPG), which is also part of the IS Department, is responsible for the cleaning and redeployment of the equipment throughout the hospital.

Even though ABC Hospital owns enough equipment to meet demand, quite often, the hospital finds it necessary to rent extra equipment because they cannot locate enough of the units within the hospital. This problem is exacerbated by equipment that accompanies the patient to another facility and by medical staff within the hospital that tend to hoard equipment when a patient is done using it instead of sending it back to the CEG to be cleaned and reissued elsewhere in the hospital. The cost to rent this extra equipment runs approximately \$300,000 per year.

Another problem the CEG has encountered involves servicing the machines. All of this equipment must be serviced periodically, including applying software updates. These updates can often be applied remotely through an embedded wireless network card within the units, but if the update fails, CEG staff must locate the unit and apply the update manually. In addition, if a piece of equipment malfunctions but is not immediately identified and tested, CEG staff must try and track down the specific machine and then test it to make sure it is operating properly. Tracking down specific machines can often take hundreds of hours of labor and might not be successful if the equipment has made its way to another facility.

The proposed goal of the project is to reduce the amount of money spent on renting equipment, to provide the SPG the ability to locate equipment that is no longer in use in order to clean it, and to provide the CEG the ability to track down equipment that needs to be serviced or tested. Access to the location reporting application is being provided, not only to CEG and SPG staff, but also to nurses in the different departments in the hospital to allow them to locate nearby equipment for their use.

B. Technical Issues

Because of the immaturity of some RFID technology, there are technical issues that ABC Hospital has faced. One of the main concerns when using technology that will broadcast information through the air is security. Remember that HIPAA, as mentioned earlier, regulates the transmission of patient data. Although its regulations are not clear when dealing with RFID technology, HIPAA could be interpreted to apply to RFID transmissions especially from tags that are assigned to medical equipment or even patients themselves. To handle this issue, ABC is encrypting the communication between the tags and the RFID/wireless network readers.

Another technical issue that must be dealt with is the placement of readers. Because ABC Hospital is using its wireless 802.11g network both for triangulation and communication with the tags, some new wireless access points needed to be added in order to allow all areas of the hospital to have adequate signal coverage. Despite these additions, there are areas of the hospital where the accuracy of the location measurement is not as high as what the IS Department would like. In fact, there are instances of a phenomenon referred to as “floor hopping,” in which an RFID tag is calculated to be either one floor above or one floor below where it is actually located. As the technology evolves and the coverage of the wireless access points improves, the occurrence of floor hopping should happen less frequently. Because of the sensitive nature of equipment in the hospital setting, technicians must be careful that RFID technology (either active or passive) does not emit signals that might interfere with other medical equipment.

The tradeoff between battery life and tag size is another technical issue that ABC has encountered. Because ABC is implementing active RFID technology, each tag must contain its own power supply. The more often each tag communicates with the reader, the more power it consumes. This has caused ABC to set the RFID tags to automatically report their position only twice per day.

C. Social Issues

There is an old adage that states “Knowledge is Power.” RFID has the ability to provide knowledge that was not available before. The ability of RFID to provide the location of a tagged person or an item at any time can make those being observed feel as if their rights are being violated and that they have lost some control over their own decisions. ABC Hospital has faced this issue while implementing the RFID project.

Used equipment is supposed to be placed in a soiled equipment closet when a patient is finished with it so that SPG staff can collect it, clean it, and redistribute it throughout the hospital. Before the RFID system was implemented, when SPG staff were unable to locate the soiled units in the various areas of the hospital, they would have to rent machines to satisfy incoming requests for equipment from other areas of the hospital. Now, SPG staff can run a report on all equipment in a certain area of the hospital and then go and find equipment that is not in use even if it has been hidden by other staff. This has enabled the hospital to eliminate the need to rent equipment to handle shortfalls.

Although both CEG and SPG staff enjoy the ease with which they are now able to track down and retrieve equipment, some of the nursing staff appear to resent the new technology. As mentioned earlier, some of the nursing staff would hide equipment when not in use so that they would have easy access to it when it was needed again. Even when nursing staff have assured CEG staff that no unused equipment was on a given wing, CEG staff have used the RFID system to find equipment that appeared to be hidden. IV pumps and blood pressure monitors have even been found in closets and elevator shafts although no one is sure how or why they were there.

Despite the fact that the nursing staff have been given access to the tracking and reporting software, they have only been given limited training on how to use it and the project manager advises that it appears most do not use the reporting system to find equipment that might be in their area even when it is needed. They are, however, able to call SPG staff to request that clean equipment be delivered. It has also been reported to the project manager that SPG staff have told the nursing staff that the RFID tag on the equipment is also able to determine if the equipment has

been handled roughly while in use. Although, this functionality is not provided by the RFID tags, some SPG staff believe that it will result in gentler treatment of the equipment by nursing staff, leading to lower repair costs.

D. Current State of the RFID Project

The RFID project has been a partial success. Because of ABC's use of RFID technology, they have been able to eliminate the need to rent extra equipment to handle demand. Both SPG and CEG are also able to locate most machines within a few feet. This has significantly reduced the amount of time spent by SPG searching for soiled units to clean and redeploy and the amount of time spent by CEG searching for specific units whose software needs to be updated manually or which might be malfunctioning. However, the RFID project manager reports that the nursing staff do not appear to be using the tracking and reporting system regularly despite the time saving advantage. In a 2005 survey, the National Alliance for Health Information Technology found that RFID applications such as this one could save clinical engineering and nursing staff as much as 16 hours per week, per staff member (Murphy, 2006). It is important to note that the IS Department does not have authority over the nursing staff and, therefore, usage of the RFID reporting software by the nursing staff is completely voluntary.

IV. Discussion

The RFID implementation at ABC Hospital has produced a shift in the balance of power between the nursing staff and the SPG giving greater control to the SPG to locate equipment while reducing the ability of the nursing staff to hide equipment for later use. Because of inadequate training with the system, some nursing staff also believe that the RFID tags are able to report abuse of the equipment which would make it seem as if the CEG group was able to police the nurses' actions. It appears that the nurses are displaying a low level of resistance to the RFID

implementation by not using the tracking and reporting software. This reduces the benefits achieved by the system.

Using the ethical principle of distributive justice and Ba, et al.'s (2001) suggestion of incentive alignment, we believe that ABC Hospital could obtain buy-in from the nurses by providing incentives to nursing staff in order to align their goals with those of the hospital while also working within the existing work practices of the nursing staff when possible. We believe this could be accomplished by enacting the following measures:

- After cleaning, return a small number of IV pumps and other equipment to a specified location on each floor so that staff can access it without contacting SPG. Create an alert within the RFID system letting the SPG know when the clean equipment supply on the floor has been exhausted so that it can be restocked.
- Share some of the economic benefits derived from the RFID project with nurses and other affected staff. Tie these bonuses to actual usage of the system and reduction in labor costs.
- Provide more extensive training to nursing staff showing the full functionality of the system and explaining the estimated time savings for both nursing and other staff provided by the system.
- Avoid creating false impressions about the functionality of the system that might lead nursing staff to believe their treatment of equipment or other actions are being monitored. If rough treatment of equipment is a concern, tie economic incentives to a reduction in equipment repair costs.

Our study was limited in that it was conducted at only one hospital and that we were not able to interview the nurses themselves to determine if our suppositions concerning the motivations of their actions were accurate. Despite this, the information provided to us by the project manager was very detailed and allowed us to study the situation in depth. It is our hope that a future study might be approved to study the effects on the nursing staff of the implementation of our suggestions.

V. Conclusion

Other studies (e.g. Kohli and Kettinger,2004; Lapointe and Rivard, 2005) have looked at the resistant response of physicians to information systems that they felt threatened their interests, but a review of the literature did not reveal any similar studies concerning the reaction of nursing staff. Answering the call of Lapointe and Rivard (2005) to examine the resistant behavior of nurses to new technology which they perceive as a threat, we examined the response of nurses and other staff within a healthcare organization to an RFID implementation.

Our study concluded that while the nursing staff at ABC hospital did not engage in open rebellion as did physicians in Kohli and Kettinger (2004) and Lapointe and Rivard (2005), they did practice a more subtle resistance to the system by refusing to use the technology and to other groups by continuing to hide equipment from the SPG staff tasked with collecting soiled equipment from them. It could be possible that the degree of resistance is correlated with the amount of power that a group holds within the organization. Other studies would be needed to determine this.

RFID technology appears to work well in the health care setting for asset tracking uses when a clearly defined, compelling need exists. ABC Hospital was able to realize a \$300,000 per year cost savings on equipment rental services in addition to possibly thousands of labor hours per year. Both CEG and SPG report being satisfied with the system and use it on a regular basis. Nursing staff, on the other hand, did not appear to have a compelling need to use the system, but may develop one now that the hospital has discontinued the practice of renting extra equipment and hoarding equipment has become more difficult. It is hoped that the implementation of the author's suggestions will also increase usage of the system by the nursing staff.

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AN EXAMINATION OF ONLINE SYNCHRONOUS COMMUNICATION IN THE E-GOVERNMENT DOMAIN

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ABSTRACT

This paper focuses on the use of online synchronous communication, specifically instant messaging (IM) in the e-government domain. E-government focuses on the use of web based products and services to support a government's interaction with different stakeholders. The two primary research questions in this paper are: 1. what is the extent to which IM is currently used in the delivery of e-government services; 2. to what extent is there complexity in the coordination of IM for e-government customer service. Initial findings indicate that IM is relatively new in the e-government domain, but presents an opportunity for an alternative method of interacting with government agencies.

Keywords: E-government, synchronous communication, IM, instant messaging

INTRODUCTION

This paper focuses on the area of e-government (electronic government) and explores the opportunities and challenges associated with online synchronous communication. The two primary research questions of this study are: 1. what is the extent to which IM is currently used in the delivery of e-government services and 2. to what extent is there complexity in the coordination of IM for e-government customer service. Synchronous communication has its origins in the social computing literature with the widespread adoption of products such as America Online's Instant Messenger (AIM) and Microsoft's MSN Messenger in the mid to late 1990s [11]. Instant messaging (IM) has migrated from informal to more formal environments such as business and education, and more recently e-government.

An exploratory content analysis methodology is used to examine the presence of instant messaging features at state level e-government sites to address the first research question. To address the complexity and different internal constituents needed for effective communication synchronous communication in an e-government context, an underlying theoretical framework of coordination theory is used. This provides the framework for addressing the second research question. As this research develops the goal is to examine the multiple levels of coordination that exists among government agents to disseminate information to different constituents. This paper presents existing literature on synchronous communication, and the specific nuances of IM in the e-government domain. The review of the literature is followed by the theoretical framework, methodology and initial findings. The paper concludes with implications of this study and future research directions.

SYNCHRONOUS ONLINE COMMUNICATION

Communication between two or more parties can occur in a synchronous or asynchronous mode. Synchronous communication refers to real time dialogue between parties that may or may not be in the same physical location. Asynchronous computer mediated communication (CMC) occurs when users interact with each other, but not in real time. Examples of asynchronous CMC include e-mail, message boards, and discussion forums. Synchronous communication includes face-to-face chat, voice communication (e.g. teleconferencing), video conferencing, instant messaging and online chat. This paper focuses on online chat and more specifically instant messaging. Chat through CMC is used in a variety of areas including entertainment, education, and business.

The terms instant messaging and online chat are sometimes used interchangeably in the existing literature, but subtle differences exist. Instant messaging is a form of chat that occurs between two parties in a CMC. Online chat is usually associated with a group environment where all members of the group can view and participate in the conversation while IM is typically a more private one on one level of communication [9]. Both IM and chat software are relatively low cost or free and readily available from vendors such as Microsoft, Yahoo and Jabber [30]. Of the 53 million Americans (approximately 18% of the U.S. population) that use IM, 11 million were using IM in the workplace [22].

Chat is a specific type of synchronous communication that has traditionally been associated with social settings. Online chat has also received significant adoption in social networking sites that bring individuals with similar interests together. Websites such as Myspace and Facebook have assimilated chat features as core components of their business. Another area of web based entertainment that has also adopted chat is online gaming. Players in multi-user online gaming environments create personas called avatars and use them for a variety of tasks including chatting, shopping, fighting and other interactive activities [29].

In the education domain e-learning environments also utilize group chat and IM. Recent literature has examined synchronous communication in e-learning from perspectives such as: role of the mediator in classroom chat [10]; effectiveness of synchronous communication in graduate education [8]; and outcomes of student-instructor cyber chat [18]. Both in-class instruction and distance education have incorporated chat as a component to enhance e-learning. In an e-learning environment on-line group chat has been successfully used as a tool for tasks such as decision making, team building, brainstorming and reflection [10].

The business world has also embraced the use of computer supported chat and IM for a variety of business related tasks. Synchronous communication via group chat provides an environment that supports real time collaborative of individuals in disparate locations. Additionally, anonymous chat sessions can also elicit feedback, suggestions and ideas from individuals that may have been unwilling to speak openly in a face-to-face direct chat session. In a business environment, IM reduces delays associated with e-mails and missed phone messages; supports employee telework; improves online customer service and facilitates organizational learning through the transcripts of online conversations [30]. Businesses also use chat as a feature to

support customer management. For example, Microsoft Corporation uses live chat sessions to provide technical support and technical discussions for end users, developers and other IT professionals [21]. Such interactive sessions provide immediate and prompt feedback to customers.

Businesses such as Bank of America and SunTrust bank have created corporate chat groups where customers can discuss topics such as mortgages and loans with a bank employee functioning as a moderator [28]. These innovative communication options can be particularly useful to customers that are actively seeking guidance and direction during current challenging financial and economic times. For a business setting the outcome of a dyadic (two-person) problem solving IM session can result in at least six different outcomes: resolved; resolved with difficulty; not resolved; mixed resolution with multiple issues; mixed resolution with single issue and other [5]. These varied outcomes highlight some of the complexity that can occur with chat communication in business or professional environments.

Synchronous CMC via chat and IM though widely accepted in social settings; and more recently in pedagogical and some professional domains are not void of challenges. Brevity of interaction, typing speed and ambiguity due to language nuances are elements that can constrain online chat communication [17]. Free flowing chat is punctuated with abbreviations and colloquialisms that may be unknown to parties that are unfamiliar with the communication group or conversational context. Social chat has evolved to create its own new language with accepted acronyms such as brb (be right back), omg (oh my god), and ttyl (talk to you later). Further, users that are new to online chat, may be nervous and apprehensive about adopting the technology [8] or feel that there is no perceived benefit when compared to alternative communication tools such as email and telephone [9]. In a business setting IM can also cause delays and interruptions of the user's work environment [24].

INSTANT MESSAGING (IM) IN E-GOVERNMENT

Government agencies have been slower than private sector firms at harnessing the power of information and communication technologies (ICTs) [7]. The field of e-government is one area that is moving government agencies into a more technology oriented arena. E-government refers to the use of ICTs by government to deliver products and services to its constituents. The primary constituents interacting with government via e-government platform are citizens, employees, business, and other government agencies. These constituent groups are often used as the basis for classifying e-government initiatives into the following four main categories: government-to-citizen (G2C); government-to-employee (G2E); government-to-business (G2B); and government-to-government (G2G).

Government employees engaged in IM with websites users conceptually can also be engaged in other tasks at their workspace. Typically, IM in the business environment involves employee-employee communication and is polycronic or involving multiple tasks [3]. IM, along with smart phones, email, social networks and other technological innovations vie for the attention of the employee. To keep up with the diverse demands and looming workplace deadlines individuals multitask with the goal of increasing productivity. However, multitasking can have an overall negative impact on the user's productivity, by increasing the risk of wasted effort [23]. To

support customer service in the e-government environment communication via IM occurs between the government agent and the user accessing the e-government site, and may have a reduced risk of the negative impact of IM when compared to IM business models that are dominated by employee-employee communication.

IM in the e-government domain is focused as a tool to improve customer service between the government and its constituents. IM represents an alternative communication channel for user interaction with government. There are several conditions under which instant messaging in e-government can occur. For example, a user may be searching for information on specific units of government or he/she may need clarification about a particular subject, or just trying to find the physical location of a government agency.

The software products used for instant messaging typically includes features that support exchange of text data; exchange of voice messages, file transfers, icons showing user presence/absence and emotional icons [30]. All features described above may not necessarily exist or be relevant at all e-government IM sites. For the business employee-employee IM communication can be initiated by either party, but the unique e-government environment considered here is that for customer service, initiation of IM communication will typically occur with the non-government user. Meaning, a visitor must first be on the e-government website before any communication is initiated. At that point either the government agent or site visitor can initiate communication. In general, human communication occurs for one of three reasons that may be independent or overlap each other: to inform, to persuade, and to entertain [2].

The implementation of e-government features via a website typically occurs as an evolutionary process. Early e-government websites are characterized by static displays of text and graphics on the home page [19]. As the e-government project matures more interactive features are included that allow two way communication between the government and constituents [1, 19]. More advanced e-government web platforms support multiple dimensions of citizen participation in the democratic process [25]. The use of a synchronous communication medium such as IM is an intermediate to advanced stage feature for e-government development. Even though the technology is readily available, the identification and participation of a knowledgeable and informed government agent(s) is necessary to ensure that the communication is both efficient and effective and satisfies the needs of the corresponding end user(s).

THEORETICAL FRAMEWORK

This paper examines the level of adoption of IM as a communication tool for customer support in state level e-government initiatives, and further explores the complexity involved in the coordination of IM for e-government customer service. To address the second part of this project, we use coordination theory as a basis for the theoretical framework. Coordination theory refers to the management of dependencies between or among activities where there exists a set of actors, activities, and goals [20]. Coordination theory further looks at the interdependence of components working towards a set of defined goals. In some instances conflicting goals arise particularly when human behavior is relevant [20]. For example, the goal of a single

communication exercise can be to both persuade and entertain, and can lead to perplexing outcomes for the recipient of the message. This can result in confusion and ambiguity.

Coordination theory emphasizes the need for smooth running of interdependent components in a system. Coordination is essential in many different environments including human, computer, and biological systems, to name a few. The act of human communication represents a specific setting requiring coordination. Both parties engage in the exchange of information as well as the acknowledgement of the receipt of information. The use of electronic means for communication represents an opportunity to apply coordination theory and examine how information is exchanged in a computer mediated environment [20].

Factors such as cost, culture and competition can impact the level of coordination in an organization. IT, when effectively used, can have a positive impact on organizational coordination. The primary benefits of IT in the coordination of a business environment are to reduce costs in the following ways: 1. substitution of IT products and services for human coordination; 2. increasing the amount of coordination by using more complex IT systems; and 3. presenting more flexible communication options for coordination [20]. In an e-government setting, a single government employee or agent can conduct simultaneous IM conversations with e-government website visitors, thus reducing the costs associated with independent agents for each conversation as in the case of phone or face-face communication, but potentially increasing complexity for internal management.

Further, the deployment of e-government services can rely on coordination across different agencies that may have previously operated independently of each other [13]. When applying coordination theory to e-government and IM, there are a variety of agents, activities, and goals involved. An agent represents any entity that is either directly or indirectly involved in the communication activity. Dyadic IM communication in e-government will consist of two agents: a government representative and a person outside of the government entity referred to as the end-user, external constituent or customer. The end-user can be a citizen, permanent resident, student, tourist, business representative or any other individual functioning in a professional or personal role when interacting with the government agent online. Government agents will be employees of the government agency, or a third party representative that acts on behalf of the government agency. An example of a third party agent can be a reference librarian that provides information to users during the IM session.

The specific events that occur when the two agents communicate via IM can initiate and facilitate several different activities. Users of e-government services may conduct activities such as a request for information, provide information to the government, or submit a complaint among others. For any coordinated IM exercise that occurs one of three communication goals exist – to inform, to persuade or to entertain [2]. Persuasion in communication can also involve negotiation, and processes and outcomes of using IM for negotiation is significantly different from face-face negotiation [14]. From an e-government perspective it seems unlikely that a user will initiate an IM session as purely an exercise in entertainment. However, additional empirical data will be needed to exclude entertainment as a goal, since individuals are motivated to act by a myriad of different reasons.

METHODOLOGY

Research studies focused on IM have used a variety of methods including: case studies to examine IM in small businesses [30]; surveys on factors affecting the adoption of IM [27]; content analysis of chat sessions to understand user perspectives [5] and observations of IM users [9]. Similarly, the field of e-government consists of methodological diversity. Recent e-government studies involve using a bibliometric study to examine e-government publications [6]; content analysis to examine e-government in the Caribbean [15]; surveys to examine cross cultural adoption of e-government [4]; and case studies to examine e-government business models [13].

The rich diversity of both IM and e-government methods indicates that for a study intersecting both areas multiple methodological options can be appropriate. Given the exploratory nature of this study a multi stage approach is used to address the two research questions. The first stage of this study examines the current literature to determine if IM or chat has been documented for any e-government levels – federal, state, or local. We began by examining both databases and publication outlets for e-government studies. In the area of e-government the primary publication outlets are Electronic Government, An International Journal (EG) ; International Journal of Electronic Government Research (IJEGR); and Transforming Government: People, Process and Policy (TGPPP) [6]. The journal Government Information Quarterly (GIQ) is also a respected outlet for quality e-government papers [26]. For phase one searches for relevant articles were conducted using the following sources: Electronic Databases - Proquest, JSTOR; and selected e-government focused academic journals: EG, IJEGR, GIQ, and TGPPP. Four key search terms were used: Instant messaging and e-government; IM and e-government; chat and e-government; and synchronous communication and e-government.

Phase 2 of this work-in-progress exploratory study involved identifying an appropriate e-government application area to examine the presence of IM functionality. From an e-government perspective studies can occur at the local, state, or federal levels. In the United States context, the state level was deemed appropriate for this study since there are 50 states it provides a finite set of options to examine, and a larger pool of sites when compared to the federal level of government. Local level e-government was excluded because of the many options such as municipalities, townships, counties, school districts and others that would need to be considered. As this research progresses, examination of local level e-government site can provide rich data for comparative analysis. In a global context, the study could be conducted at the city or municipality levels as well. However, this phase of the study focused on the fifty states of the United States.

In phase 2 we visited the website of each of the fifty states to search for any feature that allowed communication with a live representative. The only contact initiated was the use of the basic greeting ‘Hello.’ This term was used to determine if synchronous IM communication was possible and if there were at least two agents present for a coordinated activity to occur. Naturally, more specific tasks will need to be delineated as research continues on this project.

Phase 3 of this study address the complexity issue presented in the second research question. Data collected from phases 1 and 2 will provide a basis for the collection of data in phase 3. For

phase 3 we propose a case study looking at states that currently use IM for communication with website visitors. Our goal is to understand the level of coordination required to successfully answer questions and direct users. This will require interviews with the various internal constituents that support the IM application. This ranges from designers on the selection of the IM tool, the government agent that interacts directly with the web site visitor, the database administrator or support staff that maintains the transcripts of IM communication, and any other external entities such as reference librarians that may be involved in knowledge management. Based on the theoretical model using coordination theory there are at least three components: actors (eg. government representatives and end users), activities (eg. requests for information) and goals (the outcomes of the synchronous communication exercise). Additionally, developers and managers will be interviewed to understand the background planning and decision making about the reason(s) for the implementation of IM. It will be interesting to see what similarities and differences exist across the different states regarding their implementation of IM.

INITIAL FINDINGS AND DISCUSSION

Since this research is currently in progress, only findings from phases 1 and 2 are presented in this paper. Phase 1 of the study was done to determine if there was a gap in the existing literature regarding synchronous communication in the e-government domain. The majority of the databases examined returned no documents. In a few instances, where documents were returned, IM was discussed as a web or internet feature with no specific reference to e-government applications. In some cases using the search term “IM” returned documents with acronyms with the phrase, but not related to instant messaging. Specifically, document abstracts were searched to find any relevant items. The initial findings of this exploratory phase indicated that there was minimal academic literature on the use of IM in the e-government domain. However, since the field of e-government is relatively new, it provides a fertile oasis to explore a myriad of emerging concepts and theories.

Even though there were limited findings in phase 1, examination of actual e-government state projects was more fruitful for phase 2. Fifty state government sites were examined and seventeen of those sites contained links for IM or chat, and returned a live respondent with the submission of the term ‘Hello.’ Since the web is a rapidly changing environment we expect that the list of states with IM capabilities can fluctuate for any given day. The combined results of phases 1 and 2 indicate that IM applications in e-government may be at a very early stage of development. This is not surprising since government applications tend to lag behind many private sector and business initiatives. Table 1 lists the 17 states where IM was available.

Alabama	Colorado	Delaware	Hawaii	Kansas	Maine
Massachusetts	Michigan	Nebraska	New Jersey	Ohio	Oregon
Rhode Island	South Carolina	Tennessee	Virginia	Washington	

LIMITATIONS OF STUDY

This study is a work in progress and initially surveyed the current literature to identify any studies that examine IM or synchronous online communication in the context of e-government. This provides a starting point for a more in depth study of coordination and communication in the e-government context. One challenge is that only a limited selection of journals and databases were used to conduct phase 1. A broader more inclusive approach would require a review of conference proceedings as well as a broader cross section of publication outlets. To address this apparent weakness we used a representative sample of data sources to search. Secondly, the limited number of search terms may have inadvertently excluded some relevant articles.

The paper presents a theoretical framework that examines IM in the e-government context through coordination theory to address the second research question. Since the paper is more exploratory than confirmatory in nature, more empirical research is needed to support the presence of defined agents, activities and goals associated with IM in the e-government domain. There may also be other agents that are present in the coordination of synchronous communication besides the website visitor and the government representative, that are excluded in this model. Ultimately, this paper frames the starting point for a new stream of research examining the potential application, benefits and possible challenges of addressing synchronous communication into the e-government environment.

FUTURE DIRECTIONS

The current literature in the field of e-government has many opportunities for the development of innovative and unexplored streams of research. Examination of communication strategies, and in particular the use of synchronous communication tools, can provide useful information for managers, developers, and researchers in the field. Use of such technologies can be examined both from the perspectives of expected benefits and risks associated with its use.

One future research project will look at the internal adoption of IM and chat from the G2E perspective. This can be an inter-organizational or an intra-organizational study. As the e-government platform matures vertical and horizontal integration among different government units become a priority [19]. Vertical integration involves collaboration up the hierarchy, for example a project with employees from a local level government agency such as a township, with that of the state level government. Horizontal integration can exist with a project between the department of agriculture and the department of energy. In addition to integration across different units of government, e-government projects can also be collaborations with inter-sector organizations such as private and non-profit businesses [16]. Examination of internal use of IM by government employees can present a unique environment for studying the rarely examined G2E domain.

Lastly, computers and mobile devices such as cellular phones are popular options for users to engage in online chat and IM. From an e-government perspective mobile applications are poised to revolutionize the field through the growth of m-government applications. By 2013 approximately 5.8 billion people globally will be using mobile phones, with generation X and Y

as the most popular users of mobile internet applications [12]. The utilization of mobile technology to access e-government resources through features such as chat and IM can increase the adoption and use of e-government application by users that may not have traditionally accessed e-government resources. A survey can be used to examine the intention of users to adopt IM for e-government services in mobile environments and coordination of different constituents including, government agents, users, and mobile service providers.

CONCLUSION

This paper explores the use of synchronous communication via IM in the area of e-government. The main justification for examining IM in this context is the successful use of IM in other areas such as entertainment, education, and business. Currently, IM use in the e-government domain seems to be in its early stages. Additionally, through the use of coordination theory we identify the three foundation elements (agents, activities, goals) that can be applied when considering IM as a tool to support communication in the complex e-government domain. The use of synchronous online communication in e-government can serve as a catalyst to encourage new users that are familiar with IM to access e-government services. This may also be an important area for global e-government projects in countries and regions where there is a high penetration of users that are comfortable using mobile devices.

However economic, social, and even political factors can impede the adoption and use of online synchronous tools. Additionally, for the e-government context, the digital divide – which examines the disparities in technology access, further highlights limits of tools such as IM. Users that do not have access to technology such as a computer with an internet connection will not have access to communicate in a live chat session. Arguably, e-government using IM is tailored towards the user with high technical literacy that is already comfortable using web based applications. Even with the apparent challenges, there is an opportunity to explore this area and identify the specific local, regional, national, and global contexts where synchronous e-government communication can add value to governments and all constituents involved. IM in e-government can pose many interesting questions and opportunities for both practitioners and researchers.

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RESULTS OF A STUDY IN USING PANOPTO IN A DATABASE COURSE

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ABSTRACT

The growth and popularity of online courses has led to the use of videos as a tool for learning in both online courses and in the more traditional face to face class meetings. Lecture Capture Technologies such as Panopto enable an Instructor to capture important components of lectures and assignments. In fall 2009, students enrolled in MIS 3380 (Database Management) were given the opportunity to view up to ten (10) videos to enhance their productivity, learning outcomes, and the course grades. Of the seventeen (17) students in the class, ten (10) students viewed one or more videos resulting in an increase in the average exam score. Majority of the students indicated that the videos were both valuable and beneficial to understanding of the course concepts.

Keywords: Learning Strategies, Lecture Capture Technologies, Panopto

INTRODUCTION

The growth and popularity of online courses has led to the use of videos as a tool for learning in both online courses and in the more traditional face to face class meetings. Lecture Capture Technologies such as Panopto enable an Instructor to capture important components of lectures and assignments. Possible benefits to students include focusing on class, better note taking, easier recall, and availability of a “lecture” at a later date. Details on the use of Panopto in educational institutions, its integration with Blackboard, and customer “success” stories are available from its website (<http://www.panopto.com>). Some of the benefits to a faculty include increased productivity and enhanced student learning. Prior research has shown that videos are beneficial as a tool for learning in online courses [6].

BACKGROUND

Engagement of students in their learning process has been the focus of research for the last few decades. Active involvement of students in learning has been shown to be fruitful for both the teacher and the pupil. Studies have shown that learning styles have an impact on student performance [5]. Rob [4] examines the different approaches to student engagement and proposes a Leading – Learning framework to engage the students in important learning activities. Bemby and Anderson [1] discuss the importance of adding audio and video to micro computer

applications course to improve student learning. They find that utilization of audio and video technologies results in improved student performance. Tiger, Campbell, & Fitzgerald [6] find that the use of professor-developed videos in a quantitative online results in several benefits to the students. These benefits include enhanced learning, increased course satisfaction, increased faculty productivity, and intellectual property rights protection. Prior research shows that videos as an instructional tool to be more enjoyable than textbook based learning [2, 3].

THE STUDY

The Course and the Students

MIS 3380 is a three (3) credit course. This course teaches Database Management concepts to juniors and seniors. MIS 3380 is a required course for MIS majors and vast majority of the students have taken an earlier programming course (MIS 2320 – Visual Basic .Net) with the same Instructor within the past year. Occasionally there are few students who do not fall into any one of these three categories. During the fall 2009 semester, there were two repeat students including one student who took the course in the previous semester.

The Rationale for Panopto Usage

MIS 3380 is a project based course. In fall 2009, the class was offered on Tuesdays and Thursday for 105 minute session on each day. Students work alone and typically complete 15 assignments per semester. On a typical day, after an overview of the important concepts, students use Oracle (a database management software) to complete an assignment. Although a student can download the Oracle software from the Oracle’s website and use it to complete the assignments at home, due to the installation complexity and processing power requirements, most students attend the class to complete an assignment. Due to this and for incentives for attendance, most students attend the class. In the fall 2009 semester, the average attendance rate was 97%. Some students do miss classes due to illness, work, exams and assignments in other courses, non interest, the need to get up early (the class starts at 9 AM), and others.

The major reason for the decision use of Panopto on a trial basis was to improve student recall and productivity. The Instructor created 10 videos that focused on the more difficult topics and assignments in the course. Table 1 lists the incentive structure used in the class to ensure that a student views a video and provides constructive comments.

Activity	Required Or Optional	Incentive
Initial Survey	Optional	None
Videos 1 – 10	Optional	1 point per video. The total score for the video was added to the average exam score.
Final Survey	Required	Treated as an assignment. Students complete 15 assignments in a semester. Assignments account for 40% of the grade.

Table 1: Incentives

RESULTS

Table 2 shows the details of the exit survey. All students were required to complete the survey even if they did not view the videos on their own (note: the Instructor showed a majority of the videos in class using the overhead projector). Seventeen (17) students completed the exit survey (18 students completed the initial survey). As noted previously, attendance accounts for 10% of the course grade and as the students need to be present within the classroom to complete the assignment, 82% of the respondents indicated that the availability of the videos had no impact on the attendance. Majority of the students indicated that the videos were both valuable and beneficial to understanding of the course concepts.

Attendance No effect on my attendance Increased my attendance	14 3
On average, how much time would you say you spent reviewing each video? Less than 5 minutes each Between 6-10 minutes each Between 11-20 minutes each No response	 6 9 1 1
On a scale from 0-10 (10 being the highest), how beneficial were the videos viewed to your understanding of the concepts during this course? Rating: 8 – 10 6 - 7 < = 5	Mean= 6.83 9 5 3
On a scale from 0-10 (10 being the highest), how valuable were the videos you viewed during this course? Rating: 8 – 10 6 - 7 < = 5	Mean= 6.64 8 4 5

Table 2: Survey Data

Students were also asked to provide qualitative statements to assess the benefits and usage. Few of the comments are shown below and reflect the rationale for the use of the videos in the course, namely to enhance clarity and faster recall of the concepts.

“If you don’t remember a certain step in SQL you can go to the video for that section to clarify your answer instead of asking the instructor”

“Review them multiple times to understand the material completely.”

“Instead of asking the instructor the same question many times, the video can assist you. It prevents you from getting confused. The video can be viewed multiple times.”

“If you are having trouble you can view the videos for an audio/visual aid.”

It was the expectation that while “good” students may not use Panopto to a great extent, the “weaker” students in the class would use it to improve their course grade. Table 3 shows the video viewership data. Of the 17 students, 10 students viewed one or more videos resulting in an increase in the average exam score. The mean increase to the exam score was 3.95.

Video	Views
1	9
2	8
3	9
4	9
5	8
6	8
7	9
8	8
9	6
10	2

Table 3: Video Viewership

CONCLUSION

The purpose of this study is to assess the use of professor developed videos in an upper division course. MIS 3380 is a project based course. It uses the Oracle software to teach important Database Management concepts. The Instructor found Panopto to be an easy tool to use and it integrates well with Blackboard. A student can easily access the video for a particular assignment or topic without additional logins. Seventeen (17) students completed the exit survey. Due to the structure of the course, 82% of the respondents indicated that the availability of the videos had no impact on the attendance. Majority of the students indicated that the videos were both valuable and beneficial to understanding of the course concepts. Ten (10) students viewed one or more videos resulting in an increase in the average exam score. The mean increase to the exam score was 3.95.

Caution must be exercised when generalizing the results of this study. Future research should focus on extending this study to a more diverse (in-terms of technical preparation) set of student population and on comparing the results of using this study which uses professor developed videos to videos developed by publishers. As one of the purposes of college education is the preparation of a qualified work force, future studies should also focus robustness of the results over time.

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EXPLORING STUDENT ATTITUDES TOWARDS PLAGIARISM: DOES THE TYPE OF WORK MATTER?

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ABSTRACT

Academic dishonesty in college classes has long been an issue of concern. Technology tools have been used by students to gain easy access to other's work or solicit unauthorized assistance. The goal of the paper is to investigate whether students apply the same standards of acceptability for various types of assignments: essay, mathematical and programming assignments. A survey instrument was designed and administered to students in different undergraduate programming courses at a public university located in the southeastern United States. An exploratory factor analysis related to the three types of assignments was conducted. Differences of acceptable behaviors across assignment types were observed and analyzed.

INTRODUCTION

Academic dishonesty in college classes has long been an issue of concern (Bowers, 1964; Crown & Spiller, 1998; McCabe, Trevino, & Butterfield, 2001). Although students recognize that it is wrong to claim credit for another's work (Ercegovac & Richardson, 2004), there are still reports of admitted acts of cheating, plagiarism, and other forms of academic dishonesty ranging as high as 95% of the students surveyed (McCabe & Trevino, 1997). While this literature has been dominated by self-report survey methods, a recent study using the popular Turnitin plagiarism detection software found that 72% of the students in their study submitted short research papers containing some amount of copied, unattributed content (Martin, Rao, & Sloan, 2009).

Technology is a double-edged sword in the effort against academic dishonesty; while there are numerous examples of software and technological tools used to prevent and detect plagiarism (e.g., Daly & Horgan, 2005; Martin et al., 2009; McCart & Jarman, 2008) there are even more examples of students using technology to gain easy access to other's work or solicit unauthorized assistance (e.g., Campbell, Swift, & Denton, 2000; Ercegovic & Richardson, 2004; Ma, Wan, & Lu, 2008; Molnar, Kletke, & Chongwatpol, 2008; Ross, 2005). Today's college students have grown up using the Internet as a primary source of information (Tapscott, 1998); it's no wonder they will often turn to it when working on assignments. Some of the behaviors identified include copying and pasting unattributed material from online sources, sharing electronic copies of assignments with other students, and carrying on an instant message conversation while taking a computerized exam (Etter, Cramer, & Finn, 2006).

Technology is an integral part of today's academic environment. Professors often rely on technological tools to communicate with students and to distribute materials and assignments. In some courses, such as those dealing with productivity software or computer programming classes, the end product of student work is an electronic file. While several studies have explored the use of technology in cheating, to our knowledge, only one has explicitly compared students' attitudes on written versus electronic assignments (Molnar et al., 2008) finding that students view cheating with the use of technology as more acceptable than cheating without technology. We seek to expand on those findings by comparing student attitudes regarding the acceptability of a number of behaviors when working on different types of assignments.

In addition to the technological tools mentioned previously, researchers have offered a number of suggestions to combat academic dishonesty. Both honor codes and faculty responses to cheating have been found to be effective at contributing to an atmosphere of academic integrity (Crown & Spiller, 1998; McCabe et al., 2001). For in-class work, such as exams, increased surveillance has been shown to reduce cheating behaviors (Crown & Spiller, 1998). Academic dishonesty appears to be contagious among a group of students; those who observe their peers cheating are more likely to cheat themselves (Carrell, Malmstrom, & West, 2008; McCabe & Trevino, 1993). Clarification of expectations may also help to reduce academic dishonesty (Broeckelman-Post, 2008); some students may inadvertently engage in cheating because they do not understand that they are engaging in unacceptable behaviors. Examples of these types of unwitting violations might be inappropriate citation techniques or collaboration on individual assignments.

The authors of this paper have undertaken a broad research project designed to address issues mentioned. The two goals for this line of research are to:

1. determine if faculty can influence student perceptions about plagiarism through education about unethical behaviors, and
2. investigate whether students apply the same standards of acceptability for different types of assignments - that is, assignments where the product is a program versus assignments where the product is an essay or a math problem.

To accomplish the two goals, a survey was conducted on student perceptions of the acceptability of a number of behaviors when working on graded, individual assignments for a class.

Recognizing that the variety of behaviors that might be described as academic dishonesty is broad, we chose to group those behaviors into categories derived from the relevant literature (Broeckelman-Post, 2008; Jian, Sandnes, Huang, Cai, & Law, 2008). The categories used in this study are:

- seeking help from approved sources
- unauthorized collaboration
- copying portions of others' work
- copying all of others' work

The types of assignments included in the survey are:

- essay assignments
- mathematical assignments
- programming assignments

This paper reports on a portion of the findings from a broader research endeavor. The focus of this paper is to address the second goal listed: to determine whether students apply the same standards for what is considered ethical behavior for different types of assignments, while the first goal was addressed in (Aasheim, Li, Rutner, & Williams, 2010). The following sections of this paper will discuss the research method and survey instrument, report findings, and discuss both results and suggestions for future research.

METHODOLOGY

The primary purpose of this study is to determine if students have different perceptions on what constitutes academic dishonesty for various types of assignments. To this end, a survey instrument was designed and administered to students at the end of the semester in programming courses in the College of Information Technology at Georgia Southern University. The survey contained questions regarding student perceptions on various behaviors related to academic dishonesty for three different types of graded assignments: an essay assignment, a math assignment and a programming assignment.

The items in the survey were created by examining current literature to develop a set of behaviors related to academic dishonesty that applied to graded class assignments (Sheard, Dick et al. 2002; Broeckelman-Post 2008; Jian, Sandnes et al. 2008). Table 1 provides the list of questions included in the survey instrument for the section of the survey related to the programming assignment. The survey questions were presented in the order shown in Table 1 although the categories to which items belonged was not indicated. The respondents were asked to indicate (on a Likert scale of *1=Very Acceptable Behavior* to *5=Very Unacceptable Behavior*) how acceptable they felt the behaviors were on a graded programming assignment. The questions in Table 1 were modified slightly for the essay and math assignments. In addition, there were several demographic questions included.

Table 1: Survey questions related to a graded programming assignment

<p><i>How acceptable are the following behaviors?</i></p> <ol style="list-style-type: none">1. Asking the professor for help on the program.2. Asking a university provided tutor for help on the program.3. Reviewing similar programs in your textbook for ideas on how to write your program.4. Discussing ideas about the program with a fellow student but implementing the ideas independently.5. Discussing ideas about the program on an Internet news group, social networking site or blog.6. Working together on the program with a fellow student and submitting similar programs.7. Copying a few lines of another student's program while adding a significant portion of your own work.8. Copying a few lines of the program from the Internet or a textbook while adding a significant portion of your own work.9. Making minor changes to a program you had previously written for another class and submitting it for this class.10. Posting the assignment on an Internet news group, social networking site or blog and asking someone to write the program for you.11. Hiring someone or asking a tutor to write the program for you.12. Copying another student's program, making minor changes, and submitting it as your own.
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The survey was administered to students in four different undergraduate programming courses. Table 2 provides an overview of these courses. The survey was administered in class and was anonymous in that there was no identifying information on the survey. There were 155 respondents. All but four responses were complete enough to use for analysis (n=151).

DATA ANALYSIS

Demographics of Respondents

The students that responded to the survey were mostly from computing majors offered within the College of Information Technology and the College of Business Administration. The breakdown of respondents by major within these two colleges is as follows: Information Technology (45.2%), Information Systems (18.7%), and Computer Sciences (14.8%). The remainder of the respondents were from the College of Liberal Arts and Social Sciences (11.6%), College of Science and Technology (6.5%), or undeclared or left their major blank (3.2%). Females accounted for 25.2% of the respondents, males 68.4% and the remainder did not identify their gender. Ninety-one percent (91%) of the respondents were age 25 or younger. Forty-six point five percent (46.5%) of the respondents identified themselves as having a GPA of 3.0 or above. The breakdown of respondents by course can be found in Table 2.

Results

To determine if students viewed behaviors related to academic dishonesty differently depending on the type of assignment, an exploratory factor analysis on each of the questions sets related to

the three types of assignments was conducted. The underlying factors for each set of questions reveal the overall structure of student perceptions on each type of assignment.

Table 2: Courses where students were surveyed

Course	Description	Number of Survey Respondents in Course
CSCI 1236 – Introduction to Java Programming	A first course in the Java programming language targeted to Information Technology (IT) and Information Systems (IS) majors. Students are mostly freshmen.	43
CSCI 1301 – Programming Principles I	A first course in the Java programming language targeted to Computer Science (CS) majors. Students should have taken a class in another programming language such as <i>Introduction to Basic Programming</i> before taking this class. Students are mostly freshmen.	16
IT 1430 – Web Page Development	A course in XHTML, CSS and JavaScript for IT students as well as several other majors across campus that require the course for their program. IT students are typically freshmen, while the other majors are usually seniors.	39
CISM 2230 – Advanced Java	A second course in the Java programming language that is almost exclusively IT and IS majors at the sophomore level.	57

For each of the three cases the majority of bivariate correlations were significant, indicating that factor analysis is an appropriate method of analysis (Hair et al., 1998). Table 3 provides the results for the Bartlett test of sphericity, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) and Cronbach's alpha for each of the three analysis. According to Hair et al. (1998), factor analysis is appropriate based on these three measures (Bartlett test is significant, KMO > 0.5 and Cronbach's alpha > 0.7).

In all three cases, none of the 12 variables (one relating to each of the questions in Table 1) were eliminated from consideration as the measure of sampling adequacy (MSA) for each variable was over the suggested 0.50 (Hair et al., 1998) and the communalities were at an acceptable level. In all three cases, the number of factors used in the final analysis was determined by the eigenvalues greater than one criterion (Hair et al., 1998). The factor solutions with a VARIMAX (orthogonal) rotation generated using SPSS 16.0 are provided in the next three sections.

Factor analysis results for the programming assignment

Based on the eigenvalue greater than one criterion, a three factor model is appropriate for the 12 questions/variables related to the programming assignment. The VARIMAX rotated component matrix is provided in Table 4, with the underlying factor structure highlighted. Overall, the

model is a good fit as the three-factor solution explains 72.33% of the variance and Cronbach's alpha is 0.835, 0.868 and 0.906 for each of the components, respectively.

Table 3: Statistics for the factor analysis

Factor Analysis Statistics	Programming Assignment	Essay Assignment	Math Assignment
Bartlett test of sphericity	p < .001	p < .001	p < .001
Kaiser-Meyer-Olkin MSA	0.808	0.848	0.794
Cronbach's alpha	0.805	0.788	0.804

Table 4: Rotated Component Matrix – Programming Assignment

Question	Component		
	1	2	3
1	.013	.906	-.155
2	.119	.883	-.123
3	.068	.768	-.231
4	.578	.527	-.119
5	.645	.420	-.031
6	.793	.020	.235
7	.784	-.069	.369
8	.800	-.080	.259
9	.674	.175	.068
10	.146	-.190	.881
11	.189	-.160	.888
12	.226	-.187	.862

Factor analysis results for the essay assignment

Based on the eigenvalue greater than one criterion, a three factor model is appropriate for the 12 questions/variables related to the essay assignment. The VARIMAX rotated component matrix is provided in Table 5, with the underlying factor structure highlighted. Overall, the model is a good fit as the three-factor solution explains 72.41% of the variance and Cronbach's alpha is 0.951, 0.816 and .791 for each of the components, respectively.

Table 5: Rotated Component Matrix – Essay Assignment

Question	Component		
	1	2	3
1	-.250	.788	.037
2	-.082	.860	.093
3	-.099	.819	-.065
4	-.139	.650	.433
5	.030	.550	.499
6	.539	.074	.546
7	.507	-.083	.685
8	.442	.029	.713
9	.079	.209	.781
10	.918	-.208	.145
11	.918	-.177	.196
12	.900	-.182	.190

Factor analysis results for the math assignment

Based on the eigenvalue greater than one criterion, a two factor model is appropriate for the 12 questions/variables related to the math assignment. The VARIMAX rotated component matrix is provided in Table 6, with the underlying factor structure highlighted. Overall, the model is a good fit as the two-factor solution explains 64.52% of the variance and Cronbach's alpha is 0.847 and 0.809 for both components, respectively.

Comparison of the results of the three factor analysis

The factor structure is different for each of the three types of assignments, indicating a difference in student perceptions on behaviors related to academic dishonesty. Table 7 summarizes the results.

DISCUSSION AND CONCLUSION

The clear observation that can be made about our findings is that respondents did not group items into the four categories identified from the literature: approved help, unauthorized collaboration, copying portions of others' work and copying all of others' work. For essay and math assignments, the students appeared to expand the range of acceptable behaviors to include discussion of the assigned work with others including fellow students and online contacts. For programming assignments, student perceptions agreed with the categorization of Questions 1, 2, and 3 from Table 1 as acceptable behaviors. At the other end of the spectrum, for programming

assignments and essay assignments, student responses indicated that they answered questions about copying other's work in a manner that is consistent with the category. However, this was not the case with the math assignments. Across all three types of assignments, students did not appear to differentiate between unauthorized collaboration and copying portions of others' work. The other authors using these categories (Broeckelman-Post, 2008; Jian et al., 2008; Sheard, Dick, Markham, Macdonald, & Walsh, 2002) did not report factor analyses, so we are not able to compare our findings to theirs. Taken as a whole, the different patterns of loadings across the assignment types indicate that students do have different perceptions of acceptable behaviors based on the type of work being performed.

Table 6: Rotated Component Matrix – Math Assignment

Question	Component	
	1	2
1	-.061	.816
2	-.005	.802
3	.002	.791
4	.378	.696
5	.543	.572
6	.742	.256
7	.844	-.010
8	.830	-.010
9	.646	.241
10	.642	-.468
11	.650	-.536
12	.630	-.569

Table 7: Summary of factor structure

	Programming Assignment	Essay Assignment	Math Assignment
Factor 1	Questions 1 – 3	Questions 1 – 5	Questions 1 – 5
Factor 2	Questions 4 – 9	Questions 6 – 9	Questions 6 – 12
Factor 3	Questions 10 – 12	Questions 10 – 12	

There are a number of possible explanations for the observed differences of acceptable behaviors across assignment types. One possibility is that students today are often asked to work in a collaborative atmosphere both in colleges and in high schools. With respect to the essay and math assignments, it may be that they are so accustomed to working with fellow students on assignments that they do not see these behaviors as inappropriate. The different results on

acceptable behaviors on programming assignments may be attributed to a clarification of expectations. The authors of the current study taught all of the programming courses included in the survey. In these courses, each of the authors clearly specified that programming assignments were to be completed individually and that discussion of implementation details of the assignments with fellow students was not permitted.

Another possible explanation for the pattern of results observed may be that the students were evaluating the questions by their perceived level of severity of the behavior. The questions were presented on the survey in the order shown in Table 1. Students may have implicitly classified the earlier behaviors as acceptable, the middle behaviors as somewhat unacceptable, and the later behaviors as highly unacceptable. In future data collection efforts, we may wish to scramble the question presentation to minimize potential order effects and determine whether we can replicate this pattern of findings.

FUTURE RESEARCH

Two avenues for future research have been identified. First, we plan to extend the analysis to other types of computer-based, electronically submitted assignments (such as Excel spreadsheets, Access databases, etc.), perhaps focusing on required literacy/tools courses taken by business students. Second, we intend to compare our findings across students in various colleges and degree programs to see if there are any differences in perception based upon academic discipline.

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Effects of Computer Self-Efficacy Beliefs and Acceptance of Instructional Technology on Learning Outcomes

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Research in Progress

Abstract

The purpose of this study is to examine the role of student and teacher perceptions of computer self-efficacy and attitude toward computer-assisted learning as a useful form of instructional technology in improving learning outcomes and learning satisfaction. The technology acceptance model, affordance theory and computer-self efficacy theory are used to provide a theoretical framework for explaining how student and teacher efficacy beliefs and attitude relate to computer-assisted learning. A survey-based study is used to test the proposed research hypotheses. Regression analysis is used to analyze any interacting and direct causal effects of attitudes and computer self-efficacy on learning performance and satisfaction outcomes. The findings will help to identify whether there is a mutually interdependent student-teacher relationship in the successful use of instructional technology.

Keywords: affordances of learning, computer-assisted learning, computer self-efficacy, instructional technology, technology acceptance model

Introduction

Instructional technology such as computer-assisted learning (CAL) software applications has been deemed to be a critical factor in improving learning outcomes in educational institutions (Bakia et al. 2009). Information and communications technologies (ICT) have provided significant opportunities for providing flexible instructional delivery through the integration internet access and computer-assisted learning applications in the elementary school classroom (Gillies & Ashman, 2000; Wegerif, Littleton & Jones, 2003). In addition, early research in integrating technology in university academic environments has shown that it can result in improvement in critical thinking, collaboration, and problem solving skills (Bekele, 2009). In a recent review, Boulay, Coultas, and Luckin (2008) noted that instructional technology enhanced learning was observed in undergraduate e-learning, medical and work-based learning contexts. The positive results from CAL technology use in education environments are attributed mostly to the enhancement of the learning experience by vivid, playful, interactive learning environments created using multimedia courseware development tools and through student control of content sequencing and pacing that afford self-regulation of learning (Kester, Kirschner, & Corbalan, 2007). In contrast to these positive findings, some studies have found that use of instructional technology does not guarantee successful learning outcomes.

National surveys of teacher integration of technology into instruction and personal productivity found an increase in teacher use of technology as a productivity tool supporting their own work between 2005 and 2007 but no increase in the level of teacher-assignment of technology-based learning activities for students during the same time period (Bakia et al. 2009). The surveys found that teachers and students use technology more often for personal use and outside of school than they do during school activities. These findings indicate that more than just the presence of instructional technology in an education environment is needed. Students and teachers must be willing and able to effectively use instructional technology. Mixed results observed with instructional technology usage and outcomes suggest that additional empirical support to current findings and identification of new factors associated with instructional technology usage is needed. This study addresses that need by attempting to answer the following research questions:

- ◆ Does learner beliefs/attitude towards CAL impact learning performance and satisfaction outcomes?
- ◆ Does learner CAL technology efficacy impact learning performance and satisfaction outcomes?
- ◆ Does teacher belief/attitude about CAL impact learning performance and satisfaction outcomes?
- ◆ Does teacher CAL technology efficacy impact learning performance and satisfaction outcomes?
- ◆ Is the perceived quality/utility of CAL instructional/learning affordance features positively related to learning performance and satisfaction outcomes?

The technology acceptance model, affordance theory and computer-self efficacy theory are used to provide a theoretical framework for explaining how student and teacher efficacy beliefs and perceptions and attitude toward to computer-assisted learning impact learning and satisfaction

outcomes. The technology acceptance model and computer-self efficacy theoretical frameworks offers an explanation of why learners using computer-assisted learning technology must be confident in its use and accept it as a useful tool in order to achieve positive outcomes from its use. In addition, affordance theory demonstrates how the use of computer-assisted learning technology can afford positive learning outcomes.

Literature Review

Technology Acceptance and Usage

The technology acceptance model (TAM) has been continually developed in the information system literature as a theoretical framework for explaining and predicting user acceptance of information technology (e.g., Calisir, Gumussoy, & Bayram, 2009; Davis, 1989; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh et al. 2003). TAM main idea is that perceived usefulness and perceived ease of use, are the two primary motivating factors that determine an acceptance attitude and intention to use information technology.

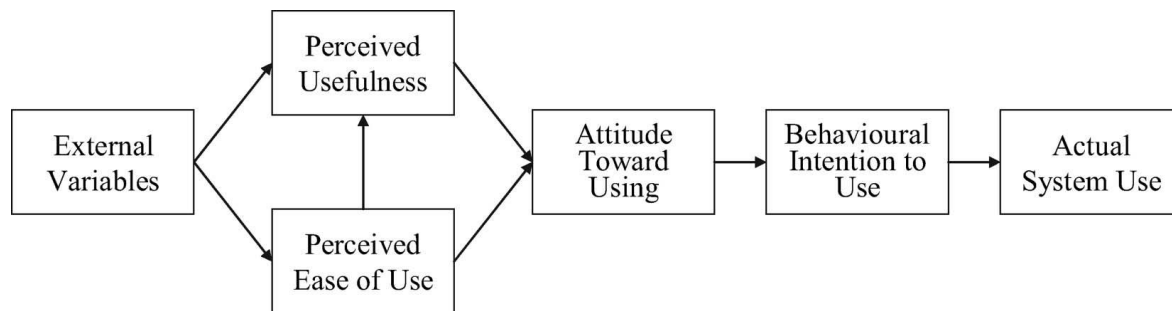


Figure 1. Technology acceptance model of Davis et al. (1989).

According to TAM, information technology acceptance and actual use is a function of external variables such as technology user beliefs, attitudes and intentions. Actual use is preceded by a behavioral intention to use the technology. System use is defined as the frequency, duration, and intensity of an employee's interactions with a particular system (Davis, 1989; Venkatesh et al. 2003). Davis (1989) defined behavioral intention as the probability that a technology user will engage in technology usage behaviors. In other words, behavior is preceded by a 'conscious plan' to perform or not perform a specific behavior. Finally, behavioral intention is motivated by positive attitude regarding perceived ease-of-use and usefulness or utility gained from its use.

The conceptual development of TAM is rooted in the psychology research literature (Davis, 1989). Venkatesh et al. (2003) provided a review of variations of TAM containing different variables in the model. The TAM framework has demonstrated good performance in explaining behavioral intention to use information technology (e.g., explaining up to 70 percent of the variance in behavioral intention to use a system, and up to 40 percent of the variance in system use). TAM provides a framework for explaining how different external antecedent variables affect perceived usefulness and perceived ease-of-use and what variables function as moderators in the overall antecedent-consequent relationship. The TAM research suggests that positive

perceptions of usefulness of computers should affect user willingness to utilize computers as both an instructional delivery and learning tool (Chau, 2001).

Affordance Theory

Using Gibson's (1977) theory of affordances, Kirschner et al. (2004) suggested that the effectiveness of an instructional or learning technology is contingent upon the technological, educational (or learning), and social affordances present in the learning environment. According to Kirschner et al. (2004), affordances are those artifacts of an environment that determine if and how the environment can be utilized to successfully complete a learning task. The technological affordances of the learning environment must facilitate instructional delivery and student learning task completion. Technological affordances refer to the "presence" of specific tools and artifacts (e.g., computer hardware and software) that support task accomplishment. Educational (or learning) affordance refers to the task environment's ability to stimulate, facilitate and maintain collaborative participation and interactions typical to the team learning process. For example, educational/learning affordance is realized through the use of lesson plans and instructional content that enable learners to interact with the technology in a meaningful way. In other words, educational/learning affordance is the ability to "derive utility" from a technology or procedure to learn to execute a specific task. Social affordance refers to the ability of a learning environment to allow peer-to-peer interactions during learning. In summary, technological, educational and social affordances are properties of the task/learning environment that determine the effectiveness of the learning process. In other words, any successful use of an instructional technology such as CAL applications will impact learning outcomes through facilitating instructional delivery of content and providing appropriate teacher-student-technology interaction.

Computer Self-Efficacy

Self-efficacy theory was derived from Social Cognitive Theory and refers to an individual's belief in his or her ability to successfully complete a certain task (Bandura, 1991). Self-efficacy theory suggests that when executing tasks, individuals are impacted by more than just their knowledge and skills, available tools and technologies, and social environment. Self efficacy theory suggests that cognition in the form of expectations of personal efficacy can impact task outcomes. The nature of the expectation is thought to come from four sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological state (Bandura, 1997).

In the IS/IT context, computer self-efficacy refers to an individual's belief in his or her ability to use computers in accomplishing a task that requires interaction with computer hardware and software applications. Computer self-efficacy has been found to be a key factor computer-related ability and the use of computers (Hasan, 2003). Individuals high in computer self-efficacy are more likely to participate in computer-related activities, expect successful task outcomes, persist in using coping behaviors when encountering difficulty, and exhibit higher levels of performance than individuals low in computer self-efficacy (Compeau, Higgins, and Huff, 1999). A positive relationship between self-efficacy and learning in training has been observed in the literature on computer-based training (e.g., Colquitt, LePine, & Noe, 2000;

Martocchio, 1994). Recently, computer self-efficacy has shown to be useful in understanding training that uses computers as a medium and training that focuses on teaching computer skills (Piccoli et al., 2001). Past research has also shown that computer self-efficacy can be positively related to learning outcomes. For example, Martocchio (1994) noted that computer self-efficacy was significantly related to gains in declarative knowledge in a microcomputer training course. In summary, computer-self efficacy has been shown to be a prerequisite to effective use of computer technology.

Research Model and Hypotheses

The research model is depicted in Figure 1 below. The model draws on the technology acceptance model, theory of affordances and computer-self efficacy theory to explain the mutual causal effects and interacting effects of both student and teacher acceptance of and beliefs in CAL utility and beliefs in their computer skills on student learning performance and satisfaction. The research model suggests that both student and teacher attitude and confidence will affect how well computer-assisted learning technology can be used in effective instructional delivery that results in increased learning.

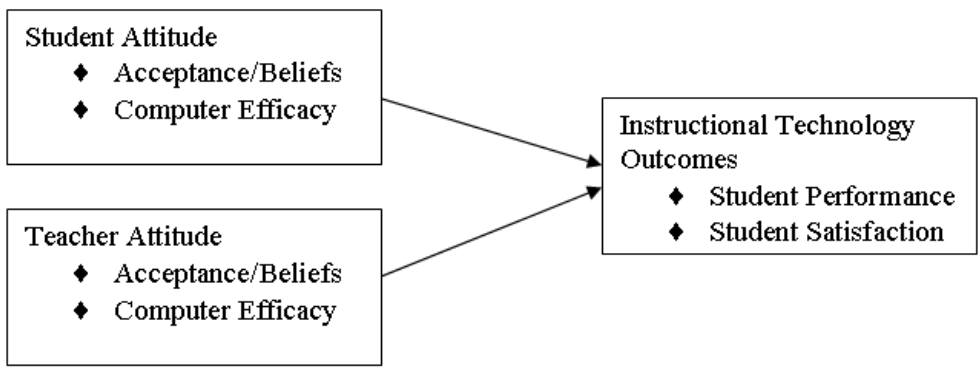


Figure 1. Research Model

Hypotheses

H1a: Student perceived usefulness of CAL will be positively related to student learning performance and satisfaction.

H1b: Student computer self-efficacy will be positively related to student learning performance and satisfaction.

H2a: Teacher perceived usefulness of CAL will be positively related to student learning performance and satisfaction.

H2b: Teacher computer self-efficacy will be positively related to a student learning performance and satisfaction.

H3a: Student perceived usefulness of CAL and teacher perceived usefulness of CAL interact to affect student learning performance and satisfaction such that the relationship will be strongest when student perceived usefulness of CAL and teacher perceived usefulness of CAL are both high.

H3b: Student computer self-efficacy and teacher computer self-efficacy interact to affect student learning performance and satisfaction such that the relationship will be strongest when student computer self-efficacy and teacher computer self-efficacy are both high.

Research Methodology

The research subjects are middle school students that use computer-assisted learning applications that facilitate math and reading skill development. The computer-assisted learning applications allow students to progress at their own pace and work individually or problem solve in a group. In addition, students are provided with immediate feedback, letting students know whether their answer is correct. The approach used to test the relationships implied in the proposed research model and the hypotheses is a survey methodology. A survey is used for data collection and multiple regression analysis is used for data analysis. Regression analysis can accommodate assessment of the impact of multiple correlated predictor variables and any associated interaction effects on a dependent variable.

Acceptance and beliefs towards instructional technology is measured using a scale adapted from items developed by Ball and Levy (2008). Computer self-efficacy is measured using items adapted from the Simmering, Posey and Piccoli (2009) scale. Subjects' learning satisfaction is measured by adapting previously validated question items (Wang 2003) with some minor wording changes appropriate to the targeted learning context. Learning performance is assessed using standardized end-of-grade math and reading scores.

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Exploring Malicious Software Trends Using Social Network Analysis

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Abstract

Security of data, hardware and networks from those who wish to steal, modify, conceal, deceive, or simply harass has become an increasingly important topic to all individuals and institutions that increasingly rely on technology to accomplish any variety of tasks. Malicious software, applications that are purposefully written to be used for malevolent intentions, is one of the primary concerns in the security arena. The purpose of this study is to perform a preliminary examination of the malicious software trends over the last 15 years, specifically focusing on changes in the infected platforms and the evolution of malicious software types over time. Using publically available data, obtained from a respected industry leader in the area, we conduct an exploratory analysis of malicious software trends using a social network analysis framework. Our analysis reinforces the severity and increasing sophistication of the malicious software problem and leads us to argue that a reexamination of malicious software taxonomies may be beneficial to assist education, awareness, management, and risk determination.

Keywords: *Social network analysis, malicious software, malware.*

Introduction

Since Fred Cohen coined the expression “computer virus” in 1984, and then credited Len Adleman for the inspiration, enterprise risk management and specifically, malicious software, attack prevention has consistently topped the management efforts of information technology professionals (Yates, 2009). As an indication of the scope of the problem, Microsoft issued a report in 2006 on its Malicious Software Removal Tool (MSRT) stating that, in a 15 month period, the tool removed 16 million instances of malicious software from 5.7 million unique Windows computers (Braverman, 2006). Symantec, a security software company, reported that over 1 million computers were infected by the Conficker worm by the close of 2008 and, that on any given day in 2008, an average of over 75,000 botnet-controlled computers existed which represented a 31 percent increase over 2007.

Security incidents, including those involving malware, can be expensive to recover from on both an individual and institutional level. For example, according to the 2008 Symantec Global Internet Security Threat Report, published annually, the average cost of a security breach for organizations in the United States on a per incident basis is \$6.7 million (US), which represents a 5 percent increase from 2007 costs (Turner, 2008). The 2008 Ponemon Institute’s Cost of a Data Breach analysis reports that the average value of lost revenue caused by a destructive security event was \$4.6 million (US) (Ponemon, 2009). While statistics on an individual level are harder to obtain, Consumer Reports in 2007 revealed that 37% of their sample of 2,000 users had their computers infected with a virus over a two-year period (CR, 2007). Recovery from a malware event on an individual level, at the very minimum requires a time commitment. Monetary losses associated with the event can result from subsequent fraud and costs for aid with the recovery

process.

A security event typically includes both a vulnerability and threat. A vulnerability is an exploitable hole in the security of a system, such as a software defect. Software companies have to continuously balance the timely release of a product with the security considerations necessary to minimize software vulnerabilities. On January 15, 2002, as an announcement of the Trustworthy Computing initiative, Bill Gates sent out a memo to every employee at Microsoft. Gates emphasized that “now, when we face a choice between adding features and resolving security issues, we need to choose security. Our products should emphasize security right out of the box, and we must constantly refine and improve that security as threats evolve.” This was a significant event in that it signaled the beginning of a renewed and more conscientious effort on the part of Microsoft to improve the security of their software products (Gates, 2002).

A security vulnerability alone is not enough to prompt a security event; there also has to be a corresponding threat. In other words, a vulnerability may exist but never cause a problem unless there is also someone with the desire, and capability, to exploit it. Malicious software is often developed by this someone with the intention of exploiting a given vulnerability. Malicious software exists in a variety of forms, with programmatic and runtime distinctions, which historically have included three major types: viruses, worms, and Trojans. Several additional terms (and could be argued, types) have been recently introduced, including: adware, spyware, dialers, and hack tools, among others.

A Brief History of the Evolution of Malware

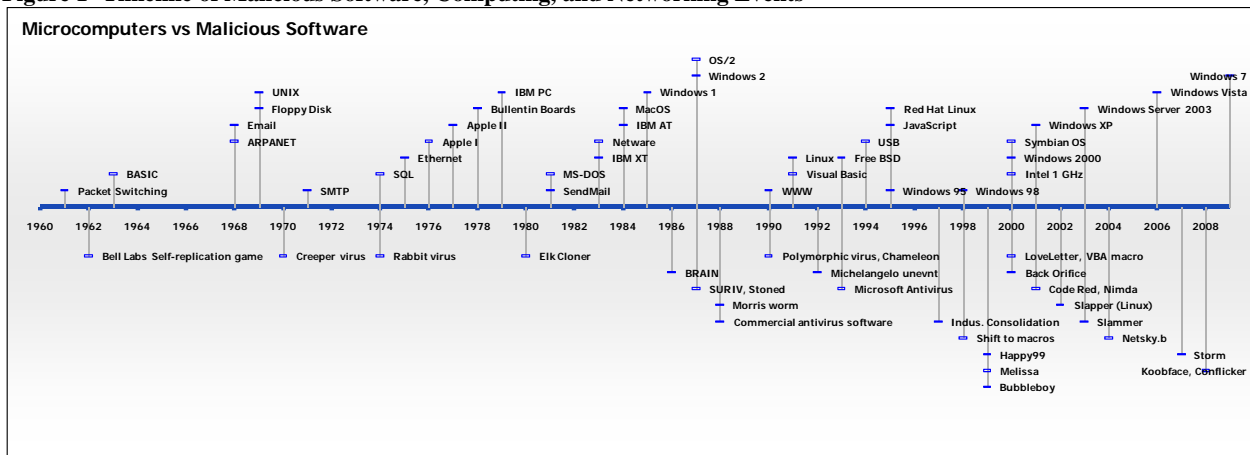
In 1962, researchers at Bell Labs created a self-replicating game named Darwin. This program introduced the theory of self-multiplying functions or computer code. Early in the 1970s, the Creeper virus was discovered on the ARPANET. Once installed and executed, the code, displayed “I’m the Creeper: Catch Me If You Can.” Soon after, the Creeper virus was introduced to the ARPANET, and if it detected the Creeper, the virus would delete it. No one ever claimed authorship of either virus. These examples represent some of the earliest instances of what would become known as malware or malicious software (Chen, 2005).

As the availability of personal computers increased, so did the number of malicious attacks. Figure 1 illustrates a timeline of some of the most important malicious software events along with notable events in computing and networking history. As can be seen in Figure 1, early in the 1980s, the first large scale virus outbreak occurred. This event can be at least partially attributed to the popularity of the Apple II platform. One of the earliest boot sector viruses, the Elk Cloner virus propagated through the use of floppy disks and displayed nuisance messages and jokes (Chen, 2005). There was minimal computer virus knowledge within the consumer computing population in the early 1980s, so most users did not understand what was actually happening. In 1986, the first outbreak of an IBM compatible virus occurred. The BRAIN¹ virus was created by two Pakistani brothers and caused extensive damage within the country of Pakistan spreading worldwide within several months. The brothers indicated that their primary purpose for deploying the virus was as an attempt to measure software piracy in Pakistan. In retrospect, this stated “purpose” became a continuous theme that followed the growth of network infrastructure and micro computing.

¹ <http://www.securelist.com/en/threats/detect?chapter=77>

The year 1988 turned out to be an unfortunate one for micro-computer users as well as for the emergent Internet. A new variant of the SURIV virus, named Jerusalem, caused a destructive worldwide outbreak on May 13th, now known as Black Friday. The author, while a student at Yisreal Radi University, claimed to be developing a new method for installing programs compiled as EXE. On November 2nd, the now infamous Morris worm was deployed by Robert T. Morris. Morris indicated that the program was intended to “measure the Internet,” but actually went viral and had the effect of causing the first denial of service attack (DOS) and basically shut down the Internet at that time. The US Governmental Accounting Office estimated damages between \$10M (US) and \$100M (US). In response to this worm, DARPA founded the Computer Emergency Response Team Coordination Center at Carnegie Mellon University (<http://www.cert.org>). Morris was convicted under the 1986 Computer Fraud and Abuse Act, fined \$10,000 (US), and sentenced to three year probation and 400 hours of community service (Whitman and Mattford, 2004).

Figure 1- Timeline of Malicious Software, Computing, and Networking Events



Later that year, the first commercial antivirus software was released by Alan Solomon and named Dr. Solomon’s Antivirus Toolkit. With this release, the antivirus software industry was born. The following year, numerous other antivirus software companies emerged and began selling commercial security software with names such as, F-Prot and Kaspersky Labs. Probably the most notable antivirus event in 1988 was when IBM began selling IBM VirusScan for MSDOS, which was developed from a declassified internal product. By 1993, after several polymorphic virus outbreaks such as Vienna, Cascade, and Chameleon, Microsoft bought Central Point Antivirus, made code modifications, and began marketing the product as Microsoft Antivirus. These events indicated that the security software industry was beginning to mature. By 1994, numerous smaller antivirus companies had consolidated, with Symantec being one of the most notable emerging from the consolidation period (Whitman and Mattford, 2004).

By 1998, the computing community had noticed a significant shift away from operating system viruses towards application oriented viruses and worms. With the advent of JavaScript, macro viruses written in that scripting language and later in Visual Basic for Applications began targeting the Microsoft Office suite as well as HTML-oriented applications such as web browsers.

The next three years saw numerous destructive worm outbreaks (Parenty, 2003). In 1999, the first modern worm, Happy99, was observed in the wild. The worm used Microsoft Outlook as its propagation medium and is still prevalent today. On March 26th of that same year, the much more destructive Melissa worm outbreak occurred. This worm was attributed to David L. Smith, who was quickly arrested, found guilty in December, sentenced to 10 years in prison, and fined \$400,000 (US) . In the fall of 1999, a new worm variant named Bubbleboy appeared that exploited a vulnerability in Microsoft Internet Explorer. By 2000, Microsoft had delivered five new versions of Windows in five short years, as illustrated in Figure 1, and held approximately 92 percent of the worldwide desktop operating system market.

On May 5th, 2000, the LoveLetter Visual Basic for Application macro worm epidemic occurred destroying local host files, while emailing itself to all addresses contained in a users Microsoft Outlook address book (CERT/CC, 2000). The outbreak broke a long standing record in the Guinness Book of Records for the largest number of computers infected by a single piece of malicious code. Occurring the same year in its name, The Back Orifice 2000 Trojan named as a pun on Microsoft's Back Office Server, was probably the first large scale worm outbreak that contained a remote control utility payload. While virus outbreaks diminished, the destructive worm outbreaks continued on into 2001, with Code Red, Nimda, and SirCam all causing significant damage by focusing on known software vulnerabilities (CERT/CC, 2001).

In 2002, Microsoft introduced its trustworthy computing initiative. However, extensive damage was still observed in the next few years, most notably as a result of several rampant worms, including: the Slammer worm in 2003 (Tolly, 2003) and the Netsky.b, MyDoom, and Bagle worms in 2004 (Foley et al., 2005). After a period of relative calm, in 2007, the Storm worm hit the Microsoft Windows platform and delivered a Trojan payload that installed a server side botnet, which, when controlled, sent out SPAM. Robot networks or botnets represent some of the most dangerous security threats to private and public network infrastructures (Stamper and Case, 2003). In 2008, the Conficker worm and numerous variants infected an estimated 15 million computers, including numerous foreign governmental agencies such as the United Kingdom Ministry of Defense and the Norwegian Police Department. There was enough data damage, that Microsoft publically announced a \$250,000 (US) reward for information leading to an arrest. The bounty is still open.

As we approach 50 years since the appearance of the first virus, several trends have been noted that provide a cursory overview of the current state of malicious software. The speed at which computer worms are able to propagate and the number of successful attacks that result from these outbreaks appear to continue to trend upward. In addition to speed and volume of attacks, the temporal window between vulnerability discovery and exploitation is shrinking. The sophistication of malicious software continues to increase with discoveries such as viruses or worms that contain functionalities, which can search for and disable antivirus software on the host computer. Many malicious programs today are the result of combinations of traditional viruses and worms, and contain numerous routines for propagation, armoring, and polymorphism. Increases in speed, severity, number, type, and sophistication of malicious applications make fighting malicious software ever more difficult (Chen, 2003).

Analysis and Discussion

To develop and support an exploratory analysis of malicious software trends utilizing a social network analysis framework, we used an extensive secondary data set obtained from Symantec, an industry leader in information security. Numerous security software vendors such as Trend Micro, McAfee, and Symantec, provide publically available security reports, open web portals, and threat alerts. These three companies have consistently provided timely and detailed security information to their customers as well as to the general public, and have collectively controlled the major market share of the data security industry. A 2009 IDC report² confirms that Symantec still controls over 31% market share of the data protection and recovery markets. Symantec's threat and virus monitoring network called, the Symantec Global Intelligence Network, is the largest network of its kind. Symantec's threat and risk reports provide the most granular information of security software vendors.

We used a web crawler to extract a full set of malicious software reports from Symantec's publically available dataset (www.symantec.com). The initial data set contained 10,410 records. Some records were incomplete and therefore not usable for our analysis. Table 1 shows the records per year obtained from Symantec's website, the number of those records that were useable, and the percentage of the total records used in our analysis for each year.

Table 1 - Sample Statistics for Symantec Dataset

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Records Available	16	13	18	42	112	583	669	1062	1532	1377	1472	1026	781	1072	489	146
Complete Records	7	8	6	23	32	72	125	735	1459	1337	1450	1013	771	1062	471	141
	43.8%	61.5%	33.3%	54.8%	28.6%	12.3%	18.7%	69.2%	95.2%	97.1%	98.5%	98.7%	98.7%	99.1%	96.3%	96.6%

We chose to explore the 15-year period from 1995 to 2010 because 1995 was the first year in which a useable sample of data points was available. It should be noted that until 2000 the number of records per year in Symantec's dataset were quite small and relatively incomplete because malicious attacks were not consistently reported and recorded at the time. A noticeable increase in the completeness of the data occurred around 2002-2003. From 2002 on, a sizeable increase in the number of malicious software occurrences is seen in the database.

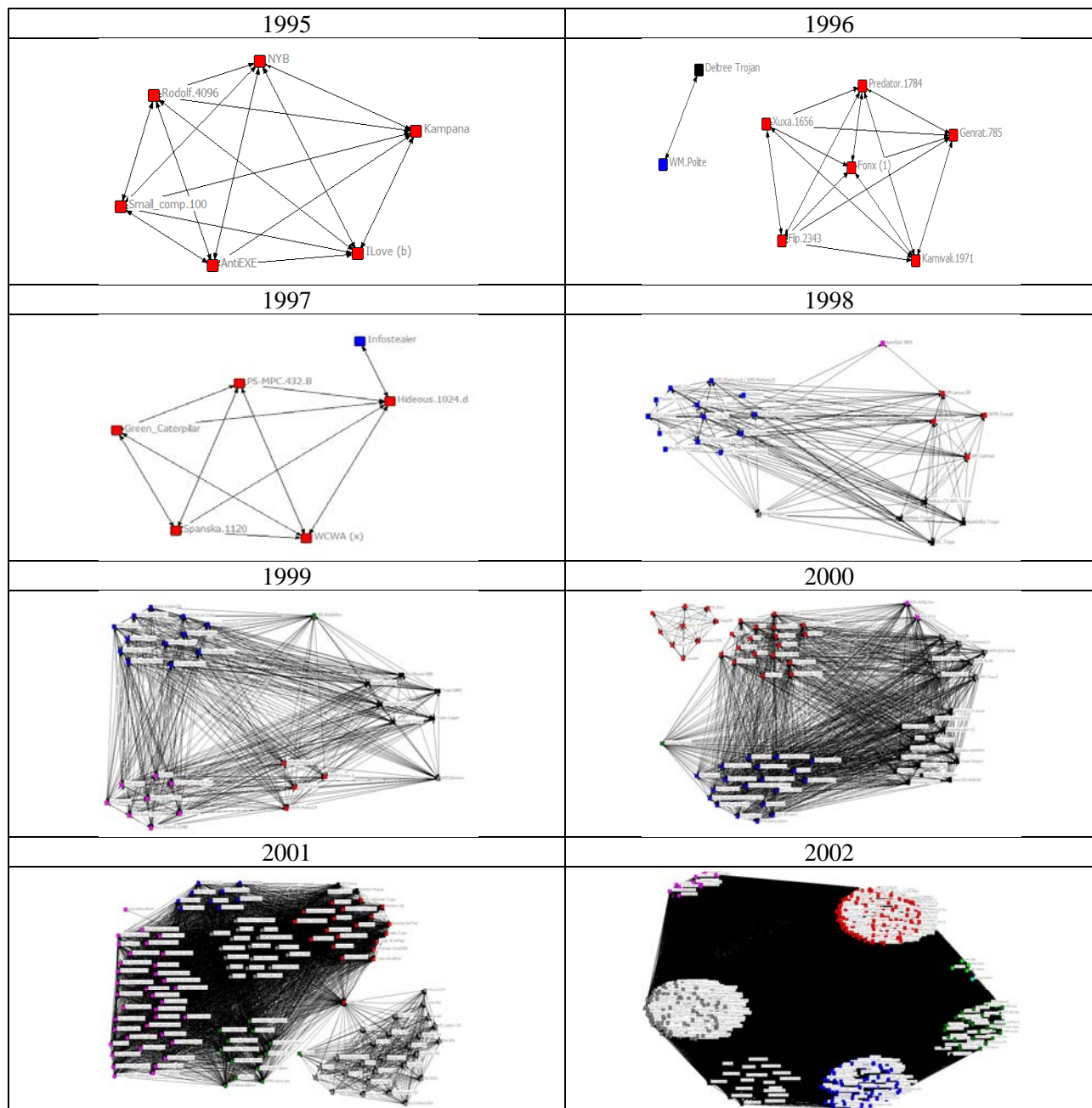
To begin our analysis, we explored the trends in both commonality in platform infection and trends in types (specified by Symantec) by reducing the data for each year into a square matrix denoting shared platforms infected by a given pair of malicious applications and then visualizing this representation using NetDraw, a graphing software package that is a part of the UCINET social network analysis toolkit (<http://www.analytictech.com/ucinet/>). Table 2 shows the malware graphs for each year from 1995-2010. As can be seen from the graphs, as well as from the data in Table 1, there is an obvious annual increase in reported malicious applications by Symantec from 1995 to 2003. Although the number of records stays high from 2004 to 2005, there are small dips from the previous years in both 2004 and 2006. A noticeable dip in reported malware applications occurs in the Symantec data in 2007 and again in 2009. The data for 2010 is only partial data since the year is not yet complete.

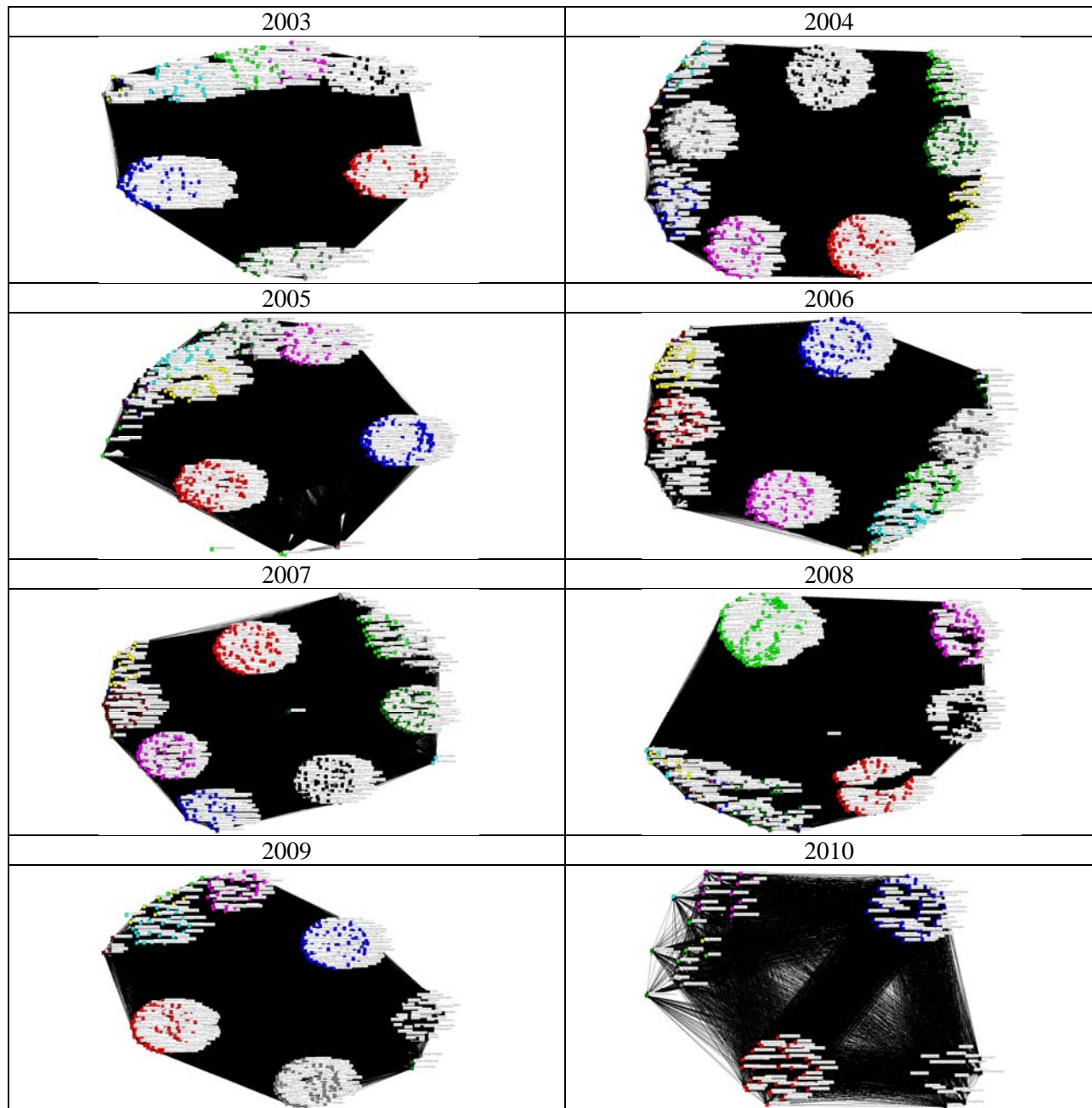
In each graph, each node represents one malware application (or one record from the Symantec dataset). An arc connects two nodes if those two malware applications infect at least one of the same platforms. The Symantec data lists only 27 unique platforms, consisting mainly of popular

² <http://www.idc.com/getdoc.jsp?containerId=prUS22106709>

operating systems: including, DOS, EPOC, FreeBSD, Java, Linux, Macintosh, Macintosh OSX, Microsoft IIS, Novell Netware, OS/2, Solaris, Symbian OS, UNIX, Windows 3.x, Windows 64-bit (IA64), Windows 64-bit (EM64T), Windows 64-bit (AMD 64), Windows 95, Windows 98, Windows CE, Windows Me, Windows 2000, Windows XP, Windows Vista, Windows NT, and Windows Server 2003. A quick visual inspection illustrates that, over time, the number of nodes increases and the density (or connection) of the graphs increase. Each colored grouping, in the graphs, represents one type, as assigned by Symantec, of malicious software. Upon visual inspection of the graphs, it can be seen that as the years pass, the number of different varieties (or types) of malicious software increases.

Table 2 - Graphs for the Years 1995-2010





We used UCINET to calculate the densities for the networks displayed in Table 2. The binary density gives us an idea of the connectivity in the graph, which gives us the proportion of how many connections are actually present in the graph with respect to all possible ties. In our domain, this ratio gives us an idea of how many malware applications did not share at least one platform in common. Table 3 illustrates that the densities of graphs increase over the years which can be largely attributed to the dominance of Microsoft platform infections, as well as the appearance of some cross-platform malware variants. The valued density provides a look at the average tie strength of the network, that is, the average number of platforms any two malware applications have in common. This also steadily increases over time and can be mainly attributed to the growing number of Microsoft operating systems.

Table 3 - Graph Densities

Year	# Nodes	Binary Density	# Ties	Valued Density	Std. Dev.
1995	6	1	30	1	
1996	8	0.5714	32	0.75	1.122
1997	6	0.7333	22	0.8667	0.718
1998	23	0.5613	284	1.8261	2.1618
1999	32	0.9859	978	4.2802	1.8039
2000	72	0.5235	2676	1.7559	2.1883
2001	125	0.6025	9338	2.9172	2.7605
2002	735	0.9477	511282	5.1721	1.6588
2003	1459	0.9697	2062852	5.258	1.577
2004	1337	0.9507	1698214	5.3899	1.952
2005	1450	0.8869	1863348	5.6194	2.3459
2006	1013	0.7978	817904	5.1487	2.7586
2007	771	0.982	582970	6.4945	1.3537
2008	1062	0.985	1109884	7.627	1.2993
2009	471	0.9706	214854	6.6901	1.9938
2010	141	0.9858	19460	6.6076	1.8721

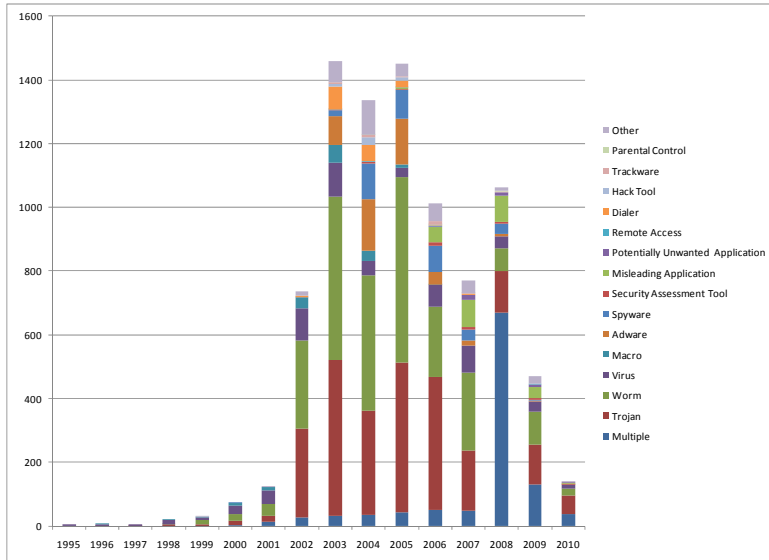


Figure 1 - Symantec Malware Types per Year

Table 4- Group Densities

Year	Multiple	Trojan	Worm	Virus	Macro	Adware	Spyware	Security Assessment Tool	Misleading App.	Potentially Unwanted App.	Remote Access	Dialer	Hack Tool	Trackware	Parental Control	Other
1995	-	-	-	1.000(.00)	-	-	-	-	-	-	-	-	-	-	-	-
1996	-	0.1429(.35)	-	0.7143(.45)	0.1429(.35)	-	-	-	-	-	-	-	-	-	-	-
1997	-	0.2000(.40)	-	0.8400(.37)	-	-	-	-	-	-	-	-	-	-	-	-
1998	0.7273(.45)	0.7273(.45)	0.1364(.34)	0.4720(.50)	0.7500(.43)	-	-	-	-	-	-	-	-	-	-	-
1999	1.0000(0)	0.9946(.07)	0.9731(.16)	0.9919(.09)	1.0000(.00)	-	-	-	-	-	-	-	-	-	-	0.9677(.18)
2000	0.6761(.47)	0.5756(.49)	0.6789(.47)	0.2999(.46)	0.7586(.43)	-	0.7183(.45)	-	-	-	-	-	-	-	-	-
2001	0.6582(.47)	0.7456(.44)	0.6676(.47)	0.4240(.49)	0.7419(.44)	-	-	-	-	-	-	-	-	-	-	0.7419(.44)
2002	0.9726(.16)	0.9411(.24)	0.9630(.19)	0.9027(.30)	0.9741(.16)	-	0.9741(.16)	-	-	-	-	0.9741(.16)	-	-	-	-
2003	0.9530(.21)	0.9735(.16)	0.9818(.13)	0.8524(.35)	0.9860(.12)	0.9856(.12)	0.9856(.12)	0.9791(.14)	-	-	0.9856(.12)	0.9856(.12)	0.9856(.12)	0.9856(.12)	-	0.9838(.13)
2004	0.9745(.16)	0.9423(.23)	0.9425(.23)	0.8625(.34)	0.9758(.15)	0.9752(.16)	0.9736(.16)	0.9753(.15)	-	-	0.9753(.16)	0.9752(.16)	0.9747(.16)	0.9753(.16)	0.9753(.16)	0.9482(.22)
2005	0.9174(.28)	0.8136(.39)	0.9190(.27)	0.9047(.29)	0.9406(.24)	0.9405(.24)	0.9402(.24)	0.9400(.24)	0.9405(.24)	-	0.9413(.24)	0.9396(.24)	0.8550(.35)	0.9406(.24)	-	0.8681(.34)
2006	0.8888(.31)	0.7203(.45)	0.8246(.38)	0.8509(.36)	0.8893(.31)	0.8893(.31)	0.8693(.34)	0.8085(.39)	0.8892(.31)	0.8893(.31)	0.8893(.31)	0.8893(.31)	0.8893(.31)	0.8892(.31)	-	0.8454(.36)
2007	0.9909(.10)	0.9701(.17)	0.9869(.11)	0.9793(.14)	-	0.9909(.09)	0.9909(.09)	0.8670(.34)	0.9909(.09)	0.9909(.09)	-	0.9909(.09)	0.9909(.09)	0.9909(.09)	-	0.9909(.09)
2008	0.9925(.09)	0.9700(.17)	0.9367(.24)	0.9925(.09)	-	0.9925(.09)	0.9925(.09)	0.9925(.09)	0.9806(.14)	0.9925(.09)	-	-	-	0.9925(.09)	0.9925(.09)	0.9925(.09)
2009	0.9850(.12)	0.9539(.21)	0.9661(.18)	0.9851(.12)	-	0.9851(.12)	0.9851(.12)	0.9851(.12)	0.9851(.12)	0.9851(.12)	0.9851(.12)	-	-	-	-	0.9454(.23)
2010	0.9929(.08)	0.9929(.08)	0.9456(.23)	0.9929(.08)	-	0.9929(.08)	-	0.9929(.08)	0.9929(.08)	0.9929(.08)	-	-	-	-	-	0.9929(.08)

To further examine trends in the major types of malicious software, we gave each node an attribute representing the malware type assigned by Symantec. This is visualized in Figure 2 by the color of each node in each graph. These types and their rate of appearance over time are also shown in Figure 2. As previously mentioned, the different types (as defined by Symantec) increase over time. This can be seen in Table 4, since the dashes in the table represent that no data was present to calculate a group density for that type that year, which tells us that the type did not appear in the useable records for that year. Figure 2 also shows an increase, peaking in 2008, of malicious software being classified by Symantec as a “multiple” type. This means, for example, that the application was listed as both a virus and a Trojan, or some other combination of the original types. This illustrates an increasing sophistication over time of malware.

Using the Symantec types as a node attribute allowed us to calculate a per group density by type. These group densities are shown in Table 4. By examining the densities by group, we get a finer view of the difference in platform infections. The earlier years, especially as the operating

systems were evolving from DOS to various forms of Windows, the original types of malware appear to be, at least reported as, less cross-platform. Trojans in particular have overall lower densities (which equates to less variants with at least one platform in common) than many of the other categories. This could be attributed to both more variety in platforms infected by Trojans and/or less cross-platform variants.

Conclusion

As is illustrated by the graphs, the densities, and the summary statistics, distinguishing among malware applications based on platform affected is difficult and does not provide much richness as a classification. However, using the operating system is one of the most common ways by which to classify malicious software (Langweg & Sneekenes, 2004). An increase in multi-function malicious software types in recent years decreases the attractiveness of trying to separate out malware applications by traditional type classifications. This leads us to argue that as malware becomes more sophisticated, methods for categorizing it must as well. While the need to categorize may, at first, sound trivial, it is not when put in context. Humans function, to a great extent, based on comparison. So if, for example, we wish to raise awareness of malicious software so as to better inform and thereby help prevent propagating infections, a rich yet concise categorization can assist in the training process. A rich and elegant categorization of malware applications may also be of use to individuals trying to determine a specific individual or institutional risk with regard to malicious software. This study provides a very preliminary exploration of a relatively comprehensive industry dataset of malicious software. By conducting this initial examination we can make a case for the need to improve and refine taxonomies for malware and also provide some initial insights that may influence the development of such a categorization.

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Toward a Better Understanding of Mexican IT Workers

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Abstract

Globalization has led to increased use of transnational work teams for software development and implementation, comprised of individuals from varied backgrounds. This paper provides a preliminary examination of the cultural and diversity perceptions of Mexican IT workers. Two instruments, the Diversity Perceptions Index and Hofstede's Value survey, were used. We collected data from 76 Mexican IT respondents in an effort to better understand the diversity and cultural views of the Mexican IT worker. Our results generally agreed with prior research which shows Mexico as a collectivist society, although we found that Mexican IT workers were surprisingly good at managing work-family life conflicts.

Keywords: diversity, culture, Mexico, cross-cultural research, IT workforce

Introduction

In the last few years, Mexico – with its inexpensive labor costs and relatively wide availability of skilled IT workers – has become an important IT outsourcing destination for many companies. As organizations become globalized, it is important to understand the culturally diverse team members in geographically dispersed locations.

While some may believe that implementation of the home country's management styles will work throughout the world, we contend that smart managers should know their workers, understanding the cultural influences and diversity perceptions of their geographically distant partners. Geographically distributed teams inevitably lead to culture clashes (Garrison, Wakefield, Xu, & Kim, 2010), and it is important for managers to be able to understand and properly supervise cross-cultural and cross-national teams (Stephens & Greer, 1995). As Mexico stands poised to increase its share of the IT outsourcing market, we need to better understand these IT team members who will contribute to successful global projects. By understanding the global IT workers, at the

personal and professional level, global organizations may be able to achieve a competitive advantage in the years to come. IT project managers who understand the culture and perceptions of workers from around the world will be positioned to effectively manage global project portfolios.

The advantages of using Mexico as an outsourcing destination are significant, and companies are beginning to realize the potential for sending IT projects to Mexico. From a North American perspective, the advantages include decreased travel times and costs, close proximity, and a strong and trusting trade relationship with potential for improved trade relations due to NAFTA.

In this paper we analyze the cultural and diversity perceptions of Mexican IT workers. What we learn may support development of better global project management practices in the increasingly diverse IT workforce. When concluded, this research study will provide an understanding into how Mexican IT workers identify with diversity in the workforce and the underlying cultural perceptions and beliefs of this group.

Literature Review

As companies are encouraged to reduce the costs of doing business, IT managers must make decisions on where to outsource functions to achieve savings. These IT leaders consider many factors, including access to a skilled workforce, governmental support and stability in the IT marketplace, and compatible cultural and diversity perceptions. Taken together, IT leaders want to select the option with widespread availability of workers who are technically competent, an environment that rewards and encourages IT development, and diversity and cultural perceptions that are in line with the home country.

Access to Skilled Labor

Mexico continues to develop a strong labor pool, with a large number of young, technically capable IT workers (Guadalajara Industry & Economy, 2010; Horowitz, 2003), a highly literate workforce (SourcingLine, 2010), over 1,000 students who receive their degrees in electrical engineering and computer science each year (Guadalajara Industry & Economy, 2010), and 18,000 graduates with IT skills (MexicoIT, 2010). Furthermore, there is an ongoing push by the government to train IT workers (Anonymous, 2009b; Guadalajara Industry & Economy, 2010; Revenna, 2010) and offer incentives to countries choosing to locate in Mexico (Dolan, 2006; Pollina, 2004), along with a good reputation for the quality of the labor force (Norvell, 2005). One concern within the Mexican IT

workforce is employee turnover of talented workers (Anonymous, 2009a), some of whom choose to leave Mexico for higher wages in the US (Luhnow, 2004).

These capable and talented IT workers find multiple opportunities to use their skills in Mexico's modern cities and states. For example, Jalisco, the state which includes the city of Guadalajara, has been labeled the "Silicon Valley of Mexico" (Guadalajara, 2010; Mexican Wholesale, 2010; Ravenna, 2010). With NAFTA in place and offering improved trade relations within North America (Bardwell, 2007; Kumar & Chase, 2006; Olson, 2004; Stephens & Greer, 1995), companies such as Siemens, IBM, General Electric, Hewlett-Packard, and Intel have outsourced IT functions to Jalisco, with promising results (Guadalajara Industry & Economy, 2010; Intel, 2010). Outside of Jalisco, a number of other global IT companies have outsourced to major hubs such as Monterrey, Guadalajara and Mexico City (So Near, 2009), providing ample opportunities for Mexicans with IT skills.

Growth of Mexico as an Outsourcing Destination of Choice

Mexico is the world's 13th largest economy with a local IT market of about \$5 billion (Viola, 2009) and currently ranks #11 out of 50 countries surveyed for IT outsourcing (So Near, 2009). Up to 40% of US based companies plan to enter or expand operations in Mexico (Kumar & Chase, 2006). Business processing outsourcing, in particular, is one of Mexico's strongest sectors, garnering 5% of the global BPO offshore market (Anonymous, 2009b), while Mexico's prominence in the electronics manufacturing industry is well-established (Alarcon, 2000). Moreover, Mexico has a commitment to improving its infrastructure and developing digital networks (Luhnow, 2004; Mexico Information Technology Report, 2010; Norvell, 2005), important factors to consider when selecting an IT outsourcer.

For its North American trading partners, selecting Mexico as an IT outsourcing destination is simple based on its proximity (Luhnow, 2004; Norvell, 2005; Pollina, 2004; Zarley, 2007), similar time zones, decreased travel times, high levels of trust between the countries (Anonymous, 2009a; O'Connor, 2007), and improved trade relations due to NAFTA (Bardwell, 2007; Kumar & Chase, 2006; Olson, 2004; Stephens & Greer, 1995). Moreover, even with some concerns over intellectual property protections (Anonymous, 2009a; Hendricks, 2004); many countries feel comfortable with the legal protections in place in Mexico (Bardwell, 2007; Norvell, 2005; Pollina, 2004). As the Latin American market continues to grow, Mexico's proximity to those markets offers an additional

advantage (Bardwell, 2007; Horowitz, 2003; Pollina, 2004). Moreover, Mexican managers are more fluent in English than their Chinese counterparts (O'Connor, 2007; Pollina, 2004; Viola, 2009).

Mexico has the lowest manufacturing costs in the Western region (Kumar & Chase, 2006) but does recognize the continued cost pressures from countries such as China, and is working to adjust and become more competitive in the global IT market (Luhnow, 2004), improving the potential for Mexico as an IT outsourcing destination (Olson, 2004). As labor-intensive manufacturing companies leave Mexico for lower-wage countries such as China, they are being replaced by technology related outsourcing (Pollina, 2004). Mexico is attempting to differentiate its IT outsourcing capabilities and has begun to attract more complex IT work (Manda, 2005).

Culture and Diversity Perceptions

While difficult to describe, researchers have refined definitions of culture over the years (Hofstede, 1980; Kluckhohn & Strodtbeck, 1961; Trompennars, 1993; Triandis, 1972), with most culture research studies focusing on the Hofstede model (Zhang & Lowry, 2008). Hofstede's model describes culture along five main dimensions: Power Distance (PDI), Individualism (IDV), Masculinity (MAS), Uncertainty Avoidance (UAI) and Long Term Orientation (LTO). Mexicans have the highest UAI, low IDV, high MAS, and high PDI (http://www.geert-hofstede.com/hofstede_mexico.shtml). Mexico has a low IDV of 30 and the second highest MAS among Latin American countries. Although Mexico has a low IDV of 30, it is higher than the average of 21 for other Latin American countries.

In terms of culture, software developers in the US are closer to their Mexican counterparts than to workers in India and China (Zarley, 2007), and Mexico has a strong understanding of the US culture (O'Connor, 2007). In fact, cultural similarities between the US and Mexico should decrease the risk of IT outsourcing projects (Anonymous, 2009a). Several researchers have compared US and Mexican workers and determined that the two groups may require very different management styles. Najera (2008) described the importance of supervision to the Mexican worker, concluding that successful companies cannot simply implement American management styles in Mexican companies, and expect success; rather, Mexican culture and values must be considered. In earlier work, de Forest (1994) found similar results, noting that managers must take Mexican values into account when considering outsourcing. While de Forest and Najera emphasized the importance of supervision to the Mexican worker, these results stand in stark contrast to the US worker, who typically desires more participatory

management styles with less supervision – an individualistic orientation. These prior studies support the contention that Mexico has a collectivist orientation, while the US is more individualistic (Gómez, Kirkman, & Shapiro, 2000). However, Church et al. (2003) note the need for more studies that examine the individualistic and collectivist cultural views of US and Mexico respondents, since research has not conclusively demonstrated the anticipated differences between the two groups. Our research should shed more light on the similarities and differences between Mexicans and their US counterparts.

Cultural values affect management style, teamwork, and the role of women, and US managers entering into an IT outsourcing partnership with Mexican companies may need to adjust their styles to accommodate these differences (Stephens & Greer, 1995). Further, human, technical, and organizational factors must be considered when outsourcing to Mexican organizations (García-Sánchez & Pérez-Bernal, 2007).

While research has shown that minority groups in the US may have different perceptions of diversity in the workplace (Woszczyński et al., 2009), little research has studied diversity perceptions of workers in Mexico specifically. We contend that this is an oversight that should be rectified to better understand these potential IT workers who reside in Mexico, a key outsourcing destination of choice. Moreover, since diversity is a potentially negative factor that must be understood when dealing with geographically distributed teams (Garrison et al., 2010), we need to understand the perceptions of the Mexican IT worker. While women in Mexico are working to become more progressive, more proactive and more career-oriented than they were in the past (Stephens & Green, 1995), updated research is clearly needed. Many argue that women's roles in Mexico are changing from the outdated male-controlled expectations of the past (Rodríguez, 2007), although they still run into obstacles to progress, such as discrimination and stereotyping (Muller & Rowell, 1997), similar to their US women counterparts.

Methodology

We delivered an online survey to gather views of Mexican IT workers. We used the modified 15-item diversity perceptions index (DPI) survey to measure diversity views of Mexican IT workers (Woszczyński, Myers, & Moody, 2007), along with Hofstede's Values Survey Module (<http://swww.uvt.nl/~csmeets/VSMChoice.html>), to measure the relationship between culture, the workplace, and home lives of Mexican IT workers. The surveys have been translated from English into Spanish and delivered online via SurveyMonkey. We targeted groups of Mexican IT workers or students, with a goal of approximately 150 respondents; we currently have 76 respondents. When

completed, this research will contribute to the growing body of knowledge on diversity and culture and help IT leaders better understand the Mexican viewpoint when planning to manage IT outsourcing projects.

Results

Our final sample size for this study is 76 respondents. Of the 76 respondents, all completed the survey, and there was no systematic pattern of missing data that needed to be addressed; instead, a few respondents may have missed a couple of questions.

Our respondents appear similar to expectations for IT workers, although we did have more women respondents than expected. Reports estimate that 24% to 26.2% of IT workers are female (Chabrow, 2007; Oneto, 2009), and 39.5% of our respondents were female, indicating a larger than anticipated number of women respondents. The respondents ranged in age from 22-50 years with 42.1% of them married. Table 1 shows the demographic characteristics of the respondents.

Number of respondents	76
Male	60.5%
Married	42.1%
Age	22-50 years old
Highest Educational Qualifications	
-less than undergraduate degree	2.6%
-undergraduate degree	43.4%
-master's degree	38.2%
-greater than a master's degree	5.3%
Major in highest educational qualification	
-Computer related	43.4%
-Engineering (including computer engineering)	22.4%
-Business management	23.6%
-Other	2.6%
Number of years of full time IT experience	0-26 years
Obtained certifications	28.9%
Have a physical disability	1.3%

Table 1: Demographics

Our respondents had between zero and 26 years of experience. Thus, we are able to capture the views of IT workers who are young and new to the field, as well as views of mature, seasoned IT workers. Over 86% of respondents earned at least an undergraduate degree. Since our sample is populated predominantly by currently working IT professionals, we should have few problems with student response bias. In fact, almost 89.4% of the respondents report that they have IT-related degrees, including computing, engineering, and business

management, further improving the generalizability of our results to the IT profession. A small number of respondents self-reported that they have one or more documented physical disabilities, at 1.3%. These numbers are only slightly below reports estimating that about 5% of IT workers are disabled (Davis & Dipner, 1992; ITAA Panel, 2003). Our respondents are predominantly Catholics as this is the principal religion practiced in Mexico. Based on the demographics of our respondents and the corresponding similarity to statistics on IT professionals, we believe that our sample is representative of the wider population of Mexican IT workers.

The first 15 items of the survey deal with diversity perceptions. Items 1-4 explain the work-family life issues faced by IT workers. These items describe how family obligations and activities fit into an IT career decision, the importance of monetary compensation in selecting an IT career, and the importance of doing work that is useful to society. Mexican IT workers feel that it is important to receive high compensation for their work, with 86.8% of the respondents agreeing or strongly agreeing that, "It is important to me that work in the IT field is well-paid." Further, 92.1% of respondents agreed or strongly agreed that, "It is important to me that work in the IT field is interesting," indicating general agreement on the need for doing work that is appealing. The group of respondents also had relative agreement on the importance of the usefulness of IT to society, with 84% agreeing or strongly agreeing that, "It is important to me that work in the IT field is useful to society." A large percentage (82.9%) agreed or strongly agreed with the statement, "It is important to me that work in the IT field allows me time for family." However, 82.8% were neutral on whether "Family obligations sometimes interfere with my work." Most of the respondents apparently felt that family obligations did not detract from work-related responsibilities. It appears that Mexican IT workers are able to balance work with family life.

Questions 6 and 7 capture the individual's teamwork preferences, specifically focusing on the desire to work alone or in groups. Almost 69.8% of respondents agreed or strongly agreed with the statement, "I prefer to work in groups on work-related projects," with a similar pattern of responses for working alone on projects.

IT history, comprised of questions 8-13, focuses on the respondents' prior work and mentoring experiences as it relates to the IT field. Almost all of the respondents from both groups agreed or strongly agreed that they had experience working with tools such as Microsoft Office, and over half of both groups had experience with computer games. Moreover, almost 2/3 of both groups agreed that they had previous work experience in IT before beginning their current position, indicating a level of maturity and knowledge in the IT industry. Over 87.6%

of both groups of respondents indicated that they knew people in the IT field, but only 52.3% of respondents agreed or strongly agreed that they had a mentor in the field.

Questions 14 and 15 capture the importance of diversity to the respondents. The statements in this portion of the survey gather respondent perceptions of the value of teamwork and individual differences in the workplace. More than half (59.2%) of the respondents agreed or strongly agreed that they preferred to work with people of different backgrounds, while 81.6% of the respondents agreed or strongly agreed that they preferred to work with people of different backgrounds.

Section 2 of the questionnaire deals with Hofstede’s Value survey. Questions 2, 7, 23 and 26 capture the Power Distance of the respondent population. Most respondents (82.9%) regarded it as very important or of utmost importance to have a boss that they respect. In addition, 76.3% of the respondents considered it of importance or of utmost important to be consulted by the boss in important decisions. On the topic of religion, 83.7% of the respondents considered religion to be moderately or of utmost importance. It was interesting to note that a large majority of the respondents (87.3%) perceive themselves to be the same person at work and at home.

Table 2 describes the Power Distance responses.

	Have a boss you respect	Be consulted by boss at work	How important is religion
No importance	2.6%	1.3%	6.6%
Little importance	2.6%	1.3%	13.1%
Moderate importance	7.9%	17.1%	23.7%
Very importance	48.7%	48.7%	36.8%
Utmost importance	34.2%	27.6%	13.2%

	Are you the same person at work and at home
Quite the same	25%
Mostly the same	52.3%
Don’t know	3.9%
Mostly different	7.9%
Quite different	3.9%

Table 2: Power Distance Responses

Individualism deals with questions 1, 4, 6 and 9, with responses summarized in Table 3. In terms of individualism, most respondents (81.5%) suggest that sufficient time for their personal life is very important or of

utmost importance. Similarly almost 87.1% of respondents suggest that job security is of utmost importance or very important. Moreover, having a job that is very interesting appears to be of utmost important to 38.2% of the respondents. However, it is interesting to note that only 25% suggest it is very important or of utmost importance to have a job that is respected by family and friends.

	Have sufficient time for home life	Have security of employment	Do work that is interesting	Have a job that is respected by friends and family
No importance	2.6%	1.3%	1.3%	2.6%
Little importance	2.6%	1.3%	1.3%	2.6%
Moderate importance	9.2%	6.6%	10.5%	26.3%
Very importance	44.7%	39.7%	44.7%	38.2%
Utmost importance	36.8%	47.4%	38.2%	25%

Table 3: Individualism Responses

Questions 3, 5, 8 and 10 discuss the masculinity index as shown in Table 4. Results show that 32.9% of respondents think it is of utmost importance to get recognition for good performance, while only 28.9% of respondents would like to work with pleasant people. In addition, 28.9% of respondents think it is of utmost importance to live in nicer areas, and more than half (52.5%) of respondents think chances of promotion are of utmost importance.

	Get recognition for performance	Have pleasant people to work with	Live in a desirable area	Have chances for promotion
No importance	1.3%	0	1.3%	1.3%
Little importance	2.6%	6.6%	5.3%	2.6%
Moderate importance	18.4%	13.1%	17.1%	6.6%
Very importance	40.8%	40.1%	43.4%	32.9%
Utmost importance	32.9%	28.9%	28.9%	52.6%

Table 4: Masculinity Responses

The next index relates to Uncertainty Avoidance, with responses summarized in Tables 5. Questions 16, 20, 24 and 27 capture this index. Almost 34.2% of respondents strongly agree that persistent efforts are essential

for success, and 36.8% of them always save before buying. More than half (52.6%) of the respondents feel that people/ circumstances sometimes prevent them from doing things while 35.5% are extremely proud of their country.

	Persistent efforts are a sure way to results
Strongly agree	34.2%
Agree	40.8%
Neither agree nor disagree	7.9%
Disagree	7.9%
Strongly disagree	1.3%

	Do people/circumstances prevent you from doing things
Yes, always	3.9%
Yes, usually	9.2%
sometimes	52.6%
No, seldom	21.1%
No, never	6.6%

	To buy something expensive, what do you do
Always save before buying	36.8%
Usually save first	31.6%
Sometimes save, sometimes borrow	17.1%
Usually borrow and then pay it off	5.3%
Always buy now, pay later	2.6%

	Are you proud to be a citizen of your country
Not proud at all	2.6%
Not very proud	6.6%
Somewhat proud	18.4%
Fairly proud	27.6%
Very proud	35.5%

Table 5: Uncertainty Avoidance

Finally, questions 15, 18, 25 and 28 relate to Long Term Orientation. As shown in Table 6, only 17.1% of respondents strongly agree that one can be a good manager even without knowing all the answers. Interestingly, 21.1% of respondents strongly agree that organization rules should not be broken even if it is for the benefit of the company. Close to half (44%) of respondents indicated that that their health is very good. It was interesting to note that 44.7% of responses mentioned that they usually are fearful of their bosses.

	Can one be a good manager without having all answers	Organization's rules should not be broken-even for benefit of company
Strongly agree	17.1%	21.1%
Agree	39.5%	21.1%
Neither agree nor disagree	11.8%	26.3%
Disagree	21.1%	22.4%
Strongly disagree	5.3%	3.9%

	State of health
Very good	44.7%
Good	39.5%
Fair	3.9%
Poor	3.9%
Very poor	0%

	How often are subordinates afraid of bosses
Never	1.3%
Seldom	11.8%
Sometimes	25%
Usually	44.7%
Always	9.2%

Table 6: Long Term Orientation

Discussion

This study provides preliminary results of the diversity and cultural perceptions of Mexican IT workers. From our results we expected respondents to exhibit collectivistic attitudes towards culture. As assumed, the respondents suggested appreciating diversity and team work. Interesting and well-paid jobs with good promotions were essential to our Mexican IT respondents. It was interesting to find that the respondents did not find much pressure in the work-life issue. They appear to manage both work and family life very well without many stresses.

Based on Hofstede's findings, we expected Mexicans to have a high UAI, low IDV, high MAS, and high PDI. Results exhibit a high PDI as assumed. Having a boss that they respect is essential for many respondents although it was interesting to note that they expected to be consulted by the boss on important issues. This was somewhat counter to our expectations for a collectivist society that preferred strong supervision. In addition, the majority of respondents claimed to be the same person at home and at work. Low IDV was clearly exhibited in the results from the data collected. Respondents expect to have jobs that give them sufficient time to spend with friends and family as well as jobs that are respected by the same.

In terms of masculinity, the respondents exhibited many masculinity qualities. They expected jobs where there is potential for promotions, preferred to live in desirable neighborhoods and get recognition for their work. Finally, our high UAI results supported Hofstede's findings. Most respondents suggested that they save before buying expensive items and agreed that persistent hardwork is important for success.

As Mexico continues to be an IT outsourcing destination of choice, it is important to understand possible cultural influences that may result when forming geographically and culturally varied groups, working to achieve goals on IT projects. Similarly, private and public partnerships in Mexico need to understand the perceptions of this

large and significant group, increasing efforts to reach out and recruit qualified Mexicans to select technology-related majors and enter the IT workforce.

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Expert Programmer: The Determinants of Exceptional Productivity

Abstract

This work highlights the importance of programmer expertise and productivity and the roles these factors play in facilitating organizational competitiveness. The paper overviews the field of expertise emphasizing the utility of deliberate practice as the predominant paradigm utilized in understanding the development of expertise. One important phenomenon, the highly-skewed distribution of programmer productivity, is brought to view and an explanation is provided why 10 percent of programmers produce approximately 50 percent of the output.

Expert Programmer: The Determinants of Exceptional Productivity

Introduction

Programmer expertise and productivity are becoming increasingly important to today's organizations which, in an attempt to be more responsive and flexible, are becoming more reliant on information infrastructure and programmer-created application layers. Interestingly, programmers' expertise and productivity and their consequent organizational impacts are extremely variable and are distributed in a highly-skewed fashion. Specifically, studies reveal that there are two general groups of programmers: experts and novices. Experts are a numerical minority who, nonetheless, are responsible for the majority of the programming output and who are found to outperform novices by a factor of anywhere from 5 to 25 (Arthur, 1983, 1985; Boehm, 1981). The most recent and precise programmer productivity study by Newby, Greenberg, and Jones (2003) illustrates that programmer expertise and resultant productivity are distributed according to Lotka's Law (1926). In their study of computer programming professionals, Newby and colleagues (2003) found that 10 percent of programmers contributed to 50 percent of the projects (see Figure 1). While the research establishes this phenomenon, there are no clear explanations for why such distribution of programmer productivity would emerge. Understanding this phenomenon, however, has far-reaching managerial implications, in particular, with respect to training, performance, and subsequent organizational competitiveness. The objective of this work, therefore, is (1) to delineate the most important findings in extant expertise literature and, on the basis of these findings, (2) to explain why 10 percent of programmers produce 50 percent of the output, and, lastly, drawing on the latter explanation, (3) to provide appropriate managerial and practical recommendations.

Insert Figure 1 about here

Expertise and its Acquisition

Before an attempt can be made to understand why 10 percent of programmers contribute 50 percent of the output, it is important to examine how expertise and its respective productivity emerge. A person's expertise acquisition process may begin with a curious and playful engagement in a particular activity (Bloom, 1985). When an interest for the activity is shown, further involvement may be facilitated by provision of resources to engage in limited amounts of practice. Typically this practice happens under the guidance of teachers or coaches. The most salient factor discovered by researchers for enabling the transition from a novice to an expert is deliberate practice (Ericsson, Krampe, and Tesch-Romer, 1993). Deliberate practice may be defined as the engagement in the appropriately challenging tasks that are selected with the purpose of improving a particular skill (Charness, Tuffiash, Krampe, Reingold, and Vasyukova, 2005). Deliberate practice has several central characteristics: 1) it is tailored to the trainee, taking into account an individual's prior knowledge and aiming to address certain deficiencies that impede the attainment of additional gains in performance, 2) it is engaged in over an extended period of time, and 3) its sessions are focused and effortful, lasting, on average, about 4 hours a day to avoid burnout (Ericsson et al., 1993; Ericsson and Charness, 1994; Folkard and Monk, 1985). It is important to note that expert performance literature draws a sharp distinction between deliberate practice and other activities, such as experience, work, and play, which are

commonly thought to be effective in increasing one's level of expertise. The differences between these are outlined in the next section.

Expertise and its Acquisition: Deliberate Practice vs. Experience, Work, and Play

Considering the relationship between expertise and experience, studies have shown that mere repetition of a particular activity may not lead to maximal productivity, and that gains in productivity may be attained when different training regimen or reward structures are used (Bryan and Harter, 1897, 1899; Keller, 1958). The correlation between experience and exceptional productivity is weak partly because individuals function below their maximally possible productivity level, suggesting that experience alone is insufficient to break the productivity plateau (Keller, 1958). Studies have shown that improvements in performance, even for highly structured tasks such as keyboard entry, were achieved only after the participants applied deliberate and targeted effort to their practice (Dvorak, Merrick, Dealey, and Ford, 1936).

Simple repetition or “working at it” is not sufficient. When the output is a public performance rendered for pay or for other extrinsic rewards, then the accomplishment of the task is directly linked to the reward structure. While this tight link between effort and reward should motivate expert performance, simply repeating the same routines does not lead to expertise. Work itself is insufficient for the attainment of expertise due to its generalist nature which affords few opportunities to target the most salient performance weaknesses. Additionally, engagement in work activities alone may not be sufficient, repetition-wise, for a trainee, to proceduralize (i.e., automate) a task that one practices (Anderson, 1982). For example, during a typical baseball game, a batter may only get 5-15 pitches (of which one or two could be relevant

to a particular weakness), whereas during the deliberate practice of the same duration, a batter working with a dedicated partner has several hundred batting opportunities where his weakness can be directly addressed (Ericsson et al., 1993; Williams, 1988).

Some suggest that expertise can be effectively developed through play. Play is viewed as activities that have no explicit goal and are inherently enjoyable, whereas deliberate practice includes activities that have been specially designed to increase the current level of performance. Play is exemplified by inherent enjoyment of the activity itself (i.e., being in the state of “flow”) or experiencing a complete immersion in the focal activity (Csikszentmihalyi, 1990). Individuals in this state experience a very pleasurable experience of effortless mastery. Developing expertise through play is unlikely since addressing areas of weakness is not inherently pleasurable; in fact it is often something to be avoided. Picture someone attempting to develop expertise in acoustic guitar through only playing. When the frustration of new techniques or complex chord sequences is encountered it would be easier to revert to more basic skills than to dissect and correct the errors. Conversely, deliberate practice is not undertaken in pursuit of pleasure but the pursuit of expertise. Deliberate practice involves making mistakes, requires effort, and is not inherently enjoyable. In deliberate practice, the specific activities are invented to overcome weaknesses, and performance is carefully monitored to provide feedback cues, which may be used to structure subsequent activities to improve performance even further (Ericsson and Charness, 1994).

While intuitively participants would like to trust in the processes of experience, work, and play to achieve expert level performance, studies suggest that they are just not enough to move one beyond novice level performance. Based on the latest studies, expertise, expert productivity, and their distinguishing characteristics are commonly acquired via deliberate

practice in the context of focused and effortful training sessions, over the extended period of time. The particular training regiment continues until certain skill deficiency is eliminated or reduced, after which the process of deliberate practice resumes again and persists, in a cyclical fashion, until the desired level of performance is attained (Charness et al., 2005; Ericsson and Lehmann, 1996; Sternberg, 1998).

Exceptional Productivity: It is not just the Programmers

The highly uneven distribution of productivity is not unique to software developers. Prior research has shown the same pattern of productivity distribution for academic researchers, inventors, and, bizarrely, even for social insects such as yellowjacket wasp with 10% of researchers, inventors, and bees producing 50% of publications (Lotka, 1926), patents (Carr, 1932; Kumar, Sharma, and Garg, 1998), and honey (Hurd, Nordheim, and Jeanne, 2003). Lotka's law has been studied most extensively among researchers and verified for such diverse academic disciplines as psychology (Furnham and Bonnet, 1992), sport psychology (Baker, Robertson-Wilson, and Sedgwick, 2003), dental science (Kawamura, Thomas, Kawaguchi, and Sasahara, 1999), finance (Chung and Cox, 1990), and information systems (Nath and Jackson, 1991). In short, the exceptional productivity noted among programmers is not a random anomaly but a systemic phenomenon that is also observed among other professionals and even the bees.

Exceptional Programmer Productivity: Explanation

As reported in the expertise literature, expert programmers are a numerical minority who are responsible for the majority of the output. However, the answers to such questions as "Why

do 10 percent of programmers contribute 50 percent of the output?” and, subsequently, “What can we learn from that?” are still lacking. The concept of deliberate practice is a good heuristic to answer these pertinent questions.

Deliberate practice may be viewed as a process, encompassing three broad phases: (1) identification of deficiencies that impede further achievement of superior performance and discrimination in selecting the most salient of these deficiencies, (2) selection or design of activities aimed at addressing the most salient of deficiencies, and (3) effortful and continual engagement in these activities over an extended period of time. The process avoids burnout and exhaustion while continuing the practice until the gains are negligible, at which point the process of deliberate practice starts again (see Figure 2). Therefore, it follows that sufficient progress towards expert performance will result only if an individual succeeds in identifying one’s deficiencies, picks tasks that are optimal for addressing the deficiencies, and, optimally, with respect to effort and time, executes these tasks.

Insert Figure 2 about here

Each of the three stages, individually, is necessary, but not a sufficient condition for the attainment of expert performance. That is, success in identifying a weakness and designing or selecting an optimal activity aimed at addressing this weakness will not lead to the attainment of higher performance unless there is also an ensuing motivation to engage in and subsequent performance of the deficiency-targeting activity (Vroom, 1964). Importantly, the three phases in the process of deliberate practice are sequential. The failure in identifying the most important skill deficiency would prevent the subsequent increase in the level of one’s performance,

regardless of the activity chosen to address a deficiency and regardless of the amount of effort applied in performing the chosen activity (unless, of course, the chosen activity, by chance, just happened to match the most salient skill deficiency).

Additional finding in the general expertise and programmer expertise literatures that applies to programmer expertise development is the 10-year-rule (Chase and Simon, 1973) and its most recent and popularized incarnation – the 10,000-hour rule (Gladwell, 2008; Poppendieck and Poppendieck, 2009). Specifically, studies show that participants do not achieve exceptional levels of performance with less than a decade or 10,000 hours' worth of training and preparation (see also Charness et al., 2005). That is, deliberate practice involves more than just a selection of a handful of activities to target the most salient skill deficiencies and then executing these activities. Deliberate practice is continuously iterative over a span of years. Few individuals are likely to have the fortitude to undergo this seemingly endless process of evaluation and reflection, training selection, and practice. And thus, in the end, only a very small number of individuals are likely to attain the status of an expert as indicated by their performance.

This study suggests that the sub-par programmer productivity is an outcome of a mismatch between training regimen the novice engages in and the novice's existing skill deficiencies. To effectively transition the novice programmer to expert requires a purposeful strategic process sustained over a significant amount of time. The posited conceptualization explains why 10 percent of programmers attain the level of expertise that allows them to contribute 50 percent of the output. That is, few individuals are likely to succeed in discovering what weaknesses or deficiencies need to be addressed to move them closer to expert-level performance. Of those who do discover their salient skill weaknesses, few are likely to succeed in selecting or designing the optimal activity aimed at eliminating or reducing the most salient

deficiency. And lastly, of those that succeed in the first two phases, few are likely to succeed in allocating the right amount of motivation, effort, and time to the selected activity.

Practical Implications

Transitioning novice programmers to the level of the expert is certainly within the interests of any organization. The high levels of productivity that experts provide allow for better organizational responsiveness and flexibility which creates a competitive advantage that is extremely difficult to copy (Katzenbach, 2000). The present study illustrates that the degree of progress towards expertise is a function of matching one's most prominent programming skill deficiency to the specific training activity that is specifically designed to overcome that skill deficiency. The particularness of such training is unlikely to be attained in a typical classroom or seminar mass-instruction regiment, but instead requires highly individualized guidance over an extended period of time. This form of deliberate practice training can, and perhaps should, be facilitated by someone who is a programming expert that possesses the ability to reliably assess the skillset of the novice trainee, communicates both explicit and tacit knowledge effectively, manages the training with respect to assignments and assessment, maintains positive attitude during the training, and elicits proper motivation without which the training is unlikely to materialize. In essence, the trainer must be both a programming and a training expert. This prescribed regiment is especially important for novice programmers who are at the very early stages of expertise acquisition. Such trainees possess very sparse knowledge and are not, for the most part, able to effectively assess and reflect on their own shortcomings and subsequently are not able to identify and structure appropriate training activities. However, under the guidance of an expert, as trainees begin to make greater progress, their knowledge becomes richer; they may

begin to require less oversight on the part of the trainer and may begin to utilize their growing expertise to move their training forward. As one progresses beyond existing levels of performance, one acquires domain-specific expertise (e.g., programming) and also grows in metacognitive abilities – abilities to monitor and make sense of one’s cognitive processes and behaviors and to use this information to guide future training (Jost, Kruglanski, and Nelson, 1998).

This study does not, however, suggest that everyone who goes through the deliberate practice-like training will transition to the level of expert. Few, if any, organizations have the resources sufficient to facilitate such instruction, and few organizations have the employees committed and aligned with their professions. The objective is not so much to transition everyone to the level of expert, but, rather, to get them past their current performance level, even by a slight margin, which, cumulatively, at the organizational level, is likely to have a substantial impact. This movement forward is more likely to be achieved via a deliberate practice process as compared to other forms of traditional instruction via classrooms and seminars. Organizations that are strategically dependent on programmers and their productivity are specifically encouraged to place more deliberate practice emphasis and investment in their training and development initiatives.

Conclusion

This study emphasizes the importance of expert programmers and their performance as integral elements in facilitating and sustaining organizational flexibility and responsiveness which leads to an organization’s improved competitiveness. Expertise and expert performance are positioned as the outcomes of deliberate practice – a sequence of specific and constantly-adjusted activities engaged in over an extended period of time for the purpose of skill deficiency

eradication and greater expertise attainment. The paper emphasizes an important phenomenon: 10 percent of programmers are contributing 50 percent of all the output. That is, the expert programmers, who are a numeric minority, are responsible for the majority of the output. The key question is: “What is the reason for this highly-skewed distribution of productivity?”

The emergence of the highly-skewed distribution of programmer productivity is not due to just passion or motivation or goal-setting or some innate talent. This study suggests that it is due to a process of programmer expertise development, based on deliberate practice, which boils down to the collective success in (1) identifying the weaknesses that stand between oneself and further expertise attainment, (2) selecting the most optimal activity to address the most focal of weaknesses, and, lastly, (3) dedicating the balanced amount of motivation and effort in executing that particular activity over an extended period of time. Probabilistically speaking, few individuals are likely to succeed in all three of these phases. The few who do succeed become experts in their respective fields.

Practically, organizations that strategically depend on programmers and their productivity are especially encouraged to adopt a deliberate practice approach to training and development. This form of highly individualized instruction should be facilitated by a mentor, who is a programming expert and who, most importantly, is able to reliably assess skills, communicate effectively, manage training, convey positive attitude, and provide motivation. The gains in programmer productivity, following deliberate practice regiment, are expected to be greater than under traditional mass-instruction methods using classroom or seminar settings. Even though few of the trainees are likely to become full-fledged experts, cumulatively, their productivity gains, following deliberate practice training, are more likely to increase organizational competitiveness than the gains they could have achieved following traditional training protocols.

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Figure 1. Distribution of Programmer Productivity

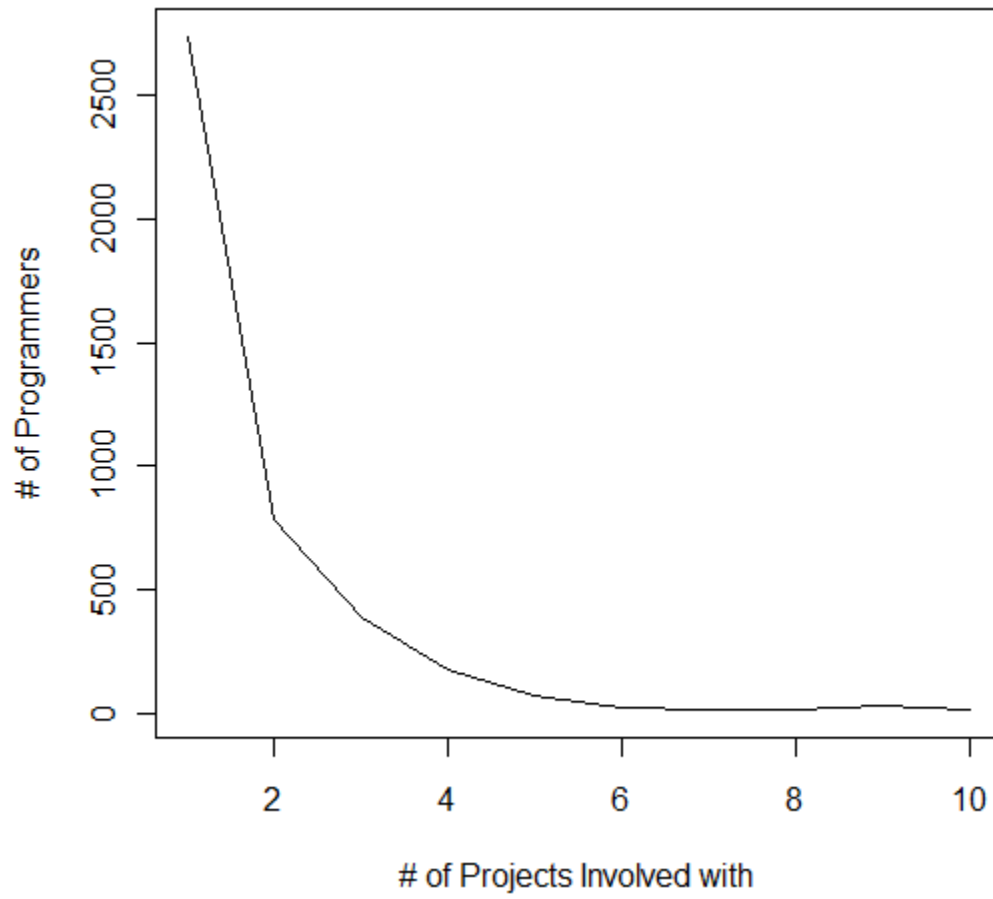
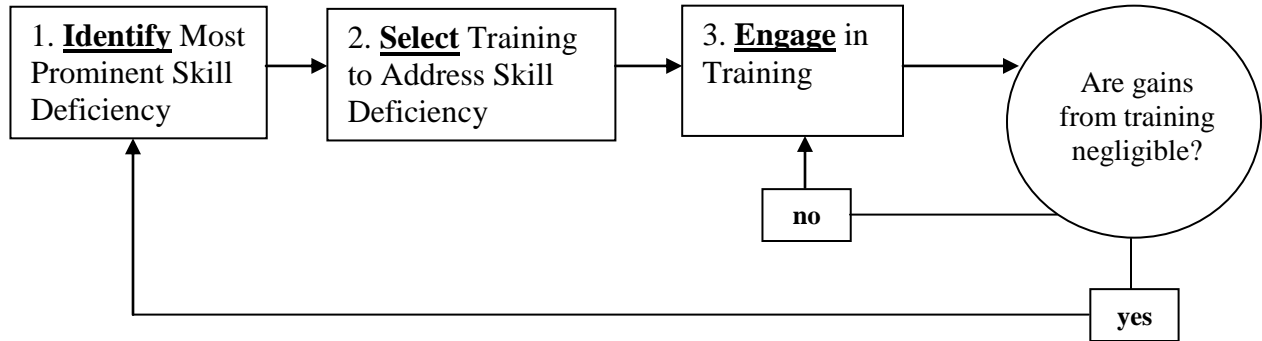


Figure 2. Phases of Expertise Acquisition



**WORK ETHIC AMONG STUDENTS:
WHAT ARE SOME OF THE MEANINGS?**

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ABSTRACT

This paper describes the set of values related to hard work and diligence in the student population within the framework of today's environment. It discusses the economic, environmental, and social factors that have shaped the development of expectations related to work. Students face a number of challenges as they attempt to succeed in an environment of rapid economic growth while maintaining environmental and social stability. This paper provides insight into the factors, behaviors, and elements that are important for student productivity, performance, and enhancement as they relate to today's values.

Keywords: applied ethics, work attitudes, success, self-fulfillment, work habits, exploration, reflection, articulation, fading, scaffolding, coaching, and modeling.

WORK ETHIC AMONG STUDENTS: WHAT ARE SOME OF THE MEANINGS?

The complexities of workforce management have long been a topic at the forefront of management studies. How workers perform their work tasks and what level of work ethic they have are central topics for study in order to understand workforce management. As educational institutions continue to prepare students with the competencies for handling workforce issues, the concept of student work ethic becomes an important, as well as, relevant business and organizational policy making topic. Nearly all discussions focused on linking or improving businesses and education capture work ethic somewhere in the discourse. Underlying questions concerning work ethic involves the development of an acceptable definition that is current with today's environment, the determination of whether work ethic is a teachable characteristic, and the development of acceptable and practical pedagogy (Miller, 2010).

Work has been with humanity since the fall of Adam and Eve in Biblical text. And, with that notion of work as a punishment for sin came the issues of determining what behaviors are acceptable and unacceptable toward work. Some have come to call this, the ethic of work. Considering these notions of work and values, we begin to form the basis of establishing a foundation about issues concerning work and begin forming the framework for work ethic (Miller, 2010).

Miller and Coady (1989) define work ethic as reliability and trustworthiness, willingness to learn, responsibility for one's actions, willingness to work, and willingness to work cooperatively, while focusing on beliefs, values, and principles. Other researchers focus on production, performance maintenance, or overall company enhancement. And even more researchers, such as Kelvin and Jarrett (Wentworth &

Chell, 1997) suggest that work ethic is really wealth ethic where wealth is perceived as the basis for economic independence and the key factor influencing one's work ethic.

Students in this generation have seen many advances in technology which have made their day-to-day work easier to manage along with the ability to properly manage that work efficiently. But in a struggling world economy, many students are not seeing the benefits these advances are supposed to provide. The work ethic is becoming obsolete because it is no longer true that producing more means working more or that producing more will lead to a better way of life.

It is here where work ethic has another dimension that adds to its dynamic nature. Work ethic is relative to the time period in which it is measured and the variables are not independently predictive. We must redefine applied work ethic to reflect the attitudes, desires, and behaviors of today's employed if we are to develop pedagogy that will foster changes in worker behavior and will be sustained as situations change. Most contemporary research focuses on teaching skills and knowledge, and not attitudes (Miller, 2010).

As society has evolved, the connection between more and better has been broken; our needs for many products and services are already more than adequately met, and many of our as-yet-unsatisfied needs will be met not by producing more, but by producing differently, producing other things, or even producing less. Our needs for air, water, space, silence, beauty, time and human contact are simply not the same as before. Modern advances in technology have made students more dependent on those technologies in order to accomplish previously "normal, everyday" functions. These functions are the abilities to communicate appropriately in social and business settings, the ability to communicate (and articulate) through well-written formal presentations, and

the ability to appropriately comprehend given instructions.

Many believe that the millennial generation will be unlike other generations in both its work expectations and in its impact on the workplace. This generation is seen as unwilling to make even the most routine sacrifices, such as visiting professors during office hours, because it is outside of the normal class time. In the workplace, jobs are more intense and insecure than before with more frequent, rapid and radical changes even though real income remains flat. Managers must adapt their expectations and approaches to make work more meaningful and extol the virtues of touchy-feely rewards (Fairlie, 2010) in place of pay and bonuses employees are not getting.

For the students in this generation, the following table will give examples of how instructors can pull the best performances out of their students:

Figure 1: Six Ways to Adapt Expectations for Students

Instructor Action	Lesson
Eliminate Ambiguity	Sets clear goals and timelines “Set the syllabus and don’t change it”
Think of time as a 24/7 Resource	Focus on results, not process. “Tell them when it’s due, not when to do it”
Combine work with play	Allow students to form their own work teams when possible
Make it worthwhile	Assign the tough problems, not just the ones you think they can handle
Handle with Care	Use criticism sparingly, frame feedback positively – “Keep the Kleenex handy”
Play to their Strengths	Let their creativity, technology skills and brainpower loose. There’s no telling where it will lead.

Source: (Phillips, 2008)

The strive for achievement along with the need to produce in a more stressful economy has made us a very individualistic society, whereas, it is no longer true that the more each individual works, the better off everyone will be. Previously, capitalism, the

lack of efficient competition, and big corporation mentalities meant that “everyone worked” in a work based society to produce as many goods as possible for the good of society at large. The more people worked the more products that could be produced to satisfy the needs of society. The present economic crisis has stimulated technological change to an unprecedented scale and speed: ‘the micro-chip revolution’ - the object and indeed the effect of this revolution has been to make rapidly increasing savings in labor, in the industrial, administrative and service sectors. Increasing production is secured in these sectors by decreasing amounts of labor (putting people out of work or reducing their hours of work). As a result, the social process of production no longer needs everyone to work in it on a full-time basis. Savings in labor also leads to reductions of perceived benefits to those workers who retain their jobs and thus a lower value for the amount of work. Some workers settle for these reductions in perceived benefits and some choose to look for other work with more benefits without the need for personal satisfaction. As work attitudes and benefits changed, work ethic ceases to be viable in such a situation and the work based society was thrown into crisis.

Contrary to the concept of greatly decreased work value changing work ethic, some researchers purport that work ethic has not declined as drastically as it appears. Rather, the content of the work ethic, in regards to personal fulfillment, has changed. People are struggling between “success” and “self-fulfillment.” In 1968, 69% of American workers felt that working hard was the way to reach personal success. That figure had declined to only 39% three short years later, by 1971 (Miller, 2010). With the current generation, we do find that today’s youth expect much more in the way of intrinsic rewards. Yet, surveys indicate that, they do not perceive that they receive these rewards even after working hard. Investigation indicates that one reason could be that the

persons imposing the reward and motivation structures are operating based on principles (scaffolding of work ethic) that are no longer appropriate.

The major barriers preventing students from seeking their education include a lack of time and money as well as a concern that the effort will not boost their career prospects. Students want to know that their education is relevant to the “new economy” and the skills they learn will help them in getting a new and rewarding job.

Some aspects of work ethic are equally important to all generations with few generational differences but if the perception is one where the student does not believe in the intrinsic reward or that it is given fairly then they usually will withdraw from a course or from that school. If they stay, they could still withdraw psychologically and reapply their extra energy elsewhere. In other words, they’ll do the minimum that’s expected of them and do what really matters to them elsewhere.

In a highly industrialized society, working hard was the key principle to intrinsic rewards from the company but many of those who worked for firms for many years were some of the first casualties of the ‘micro-chip revolution’ because they were all of a sudden, not efficient enough or were outsourced by cheaper, more efficient alternative labor. It wasn’t about the amount of production anymore in the eyes of the firm; it was about the amount of efficiency that became the key principle for firms. When more senior workers, who were less efficient with new techniques on the job, were phased out of the system firms began to see increased profits without the increased and, at many times, unnecessary extra production. The firms were also able to benefit from phasing out senior workers’ large salaries and even larger retirement plans.

Along with not handling reductions of staff appropriately, managers of these firms were also not capable of restructuring rewards of satisfactory work to the benefit of their

workers fairly. There was no re-education of workers so they could take advantage of this new key principle of efficiency to “save” the most jobs possible. According to the previous work philosophy, when production was not needed, workers were cut as opposed to re-education or relocation to other department and roles within the firm. At this point, workers felt devalued and betrayed according to the previous principle of hard work and perceived rewards.

A Collegiate Employment Research Institute survey (Hansen, 2009) reflects a long-term trend toward producing more college graduates than labor markets can absorb. This trend is exacerbated by an equally long-standing mismatch in the fields of study that students pursue and the skill sets that employers require. Some companies are moving away from experienced hires to concentrate on the new college graduates, primarily because of costs. Additionally, employers seeking health professionals, engineers, computer scientists and scientists are the most likely to anticipate difficulties in hiring the necessary talent because of the lack of graduates with those particular needed skills. Companies say they are having trouble finding qualified workers and add that skill deficiencies of current employees are dragging down productivity (Schoeff, 2009).

In analysis, the concept of work ethic can be questioned according to the new principle of efficiency since there are naturally some conflicts between the two in regards to the focus on measured results based on quality, and no longer quantity. Some writers started to state simply that work ethic is a willingness to stay employed (and overall was fading) while others focus on beliefs, values, and principles (Miller, 2010).

Beliefs, values, and principles of work ethic and work habits are simply what are taught during a student’s upbringing. If that student was taught good basic beliefs, values, and principles about how a person should work then that student will carry those

qualities into the work they possess later in life. The reflection and realization of what their parents or guardians have accomplished will be evident during that upbringing and the student will be able to evaluate how those accomplishments have correlated with the work ethic their parents or guardians possessed. At any moment in time throughout life and throughout history, those who are recognized as successful in their work can also serve in the coaching or modeling capacity for a student.

There will be many occasions where these beliefs, values, and principles will be challenged by others and it is up to the individual to retain the qualities viewed as valuable for their own personal success. Additionally, since there is an absence of appropriate work ethic in today's society, firms must model themselves and the behaviors of their employees according to the company philosophy of work. A "normalized" initiative for firms to educate according to the expectations of the company provides meaning for students (their future employees) with effective (and efficient) communication to bridge an appropriate (social) philosophy with an appropriate (focus on results) wealth creation ethic.

The Research Study

In an effort to evaluate current day work ethic toward both a student's academic efforts and efforts on the job, a quantitative research study was performed which involved a survey of 160 students at a major university in Pennsylvania. Work ethic and job involvement questions in the survey dealt with ethical and unethical issues in academic and non-academic topics.

Two research questions are presented in this study. First, what degree of importance do students place on values and factors related to hard work and diligence in academic and post academic work? Second, are student perceptions toward their efforts

in academic and post academic work more ethical or unethical?

The three part survey questioned students' measurement of six factors / behaviors / elements important for productivity, performance and enhancement in today's academic and post academic workplace. The factors measured were, 1) Pride in Work, 2) Job Involvement, 3) Activity Preference (measuring the importance of being active in one's work), 4) Attitude Toward Earnings, 5) Social Status on the Job (measuring the importance of respect from performance), and 6) Upward Striving (measuring a student's desire to move up or be promoted). Part one consisted of 26 questions which allowed the students to measure work ethic and job interest in regard to situations while on the job. Part two consisted of 23 questions which allowed the students to measure work ethic and job interest in regard to situations while in school. Part three consisted of 26 questions which allowed the students to measure work ethic and job interest in regard to situations while both on the job and at school.

To effectively understand and measure the degree of importance students place on values and factors related to hard work and diligence in academic and post academic work, three hypotheses were tested for research question 1. A student's academic experience serves as important preparation for their future selected career. Habits and traits formed and practiced in academics lead to habits and traits in post academic work. Students who excel high in academic performance typically attribute their success to hard work and high regard for superior performance. Considering the importance of strong a work ethic as correlated to academic excellence, we contend and test:

H₁: Students place a high degree of importance on values and factors related to hard work and diligence in post academic work.

After earning an academic degree, students' habits and values influence their

perception toward work in the post academic setting. Excellence in the post academic setting is typically achieved via strong work ethics often acquired in the pre-academic and academic setting. Considering the importance of work ethic acquired in a student's academic years on their post academic work, we maintain:

H₂: Students place a high degree of importance on values and factors related to hard work and diligence in academic work.

For successful individual, work ethic does not simply end at some stage in an individual's life. Continued belief in high values and strong work ethic in the combined academic and post academic environment are essential for long term success of individuals and continuous improvement in modern day organizations. Considering the required need for a total work ethic perspective on both academic and post academic performance, we test and assert:

H₃: Students place a high degree of importance on values and factors related to hard work and diligence in combined academic and post academic work.

To effectively understand and measure whether student perceptions toward their efforts in academic and post academic work are more ethical or unethical, two hypotheses were tested for research question 2. Strong work ethic is not exhibited by a "hit and miss" exhibition of qualities. Consistency in ethical beliefs and practice support a strong work ethic. This consistency should be measured in various capacities across a spectrum of situations. Considering the need for acting in a consistent ethical manner to promote organizational and worldwide improvement, we contest:

H₄: Student perceptions favor strong ethical values when placed in situations impacting ethical dilemmas.

The aforementioned consistent application of ethical behavior should also be exhibited in situations where students / workers are faced with unethical dilemmas. Being placed in unethical situations often places one in a situation where temptation exists in taking a possible unethical path where personal reward and a reduced amount of work / effort are taken resulting in an unfortunate outcome for the majority of those impacted.

Ethical values tend to be codified into a formal system or set of rules which are explicitly adopted by a group of people (usually in a specific profession). Ethical values are thus internally defined and adopted, whereas morals tend to be externally imposed on other people. If you accuse someone of being unethical, it is equivalent of calling them unprofessional and may well be taken as a significant insult and perceived more personally than if you called them immoral.

The unethical path is often the easier path with more immediate self reward resulting in long term negative implications and pain for others. Considering the importance for students to practice strong ethical values when placed in unethical situations, we propose:

H₅: Student perceptions favor strong ethical values when placed in situations impacting unethical dilemmas.

Data Analysis and Results

Demographic information of the sample surveyed follow in tables 1 through 8:

Table 1 – Gender of Students Surveyed

Gender	Frequency	Percent
Male	93	58.1
Female	67	41.9
Total	160	100.0

Table 2 – Major of Students Surveyed

Major	Frequency	Percent
No Response	8	5.0
Math / Science	23	14.4
Math / Science & Business	1	0.6
Math / Science & Technology	1	0.6
Math / Science & Engineering	1	0.6
Business	67	41.9
Human Services	21	13.1
Technology	10	6.3
Engineering	20	12.5
Liberal Arts	3	1.9
Education	4	2.5
Psychology or Social Sciences	1	0.6
Total	160	100.0

Table 3 – Race of Students Surveyed

Race	Frequency	Percent
Caucasian	152	95.0
African-American	2	1.3
Native American	2	1.3
Hispanic	1	0.6
Asian-American	3	1.9
Total	160	100.0

Table 4 – Age of Students Surveyed

Age	Frequency	Percent
18 - 23	119	74.4
24 - 29	15	9.4
30 - 35	10	6.3
36 - 40	6	3.8
41 - 45	5	3.1
46 - 49	3	1.9
50 and older	2	1.3
Total	160	100.0

Table 5 – Marital Status of Students Surveyed

Martial	Frequency	Percent
Not Married	141	88.1
Married	19	11.9
Total	160	100.0

Table 6 – Number of Children of Students Surveyed

Children	Frequency	Percent
0	127	79.4
1	12	7.5
2	12	7.5
3	7	4.4
5	1	0.6
6	1	0.6
Total	160	100.0

Table 7 – Academic Classification of Students Surveyed

Academic Classification	Frequency	Percent
Freshman	47	29.4
Sophomore	49	30.6
Junior	28	17.5
Senior	35	21.9
Other	1	0.6
Total	160	100.0

Table 8 – Generation Classification of Students Surveyed

Generation Classification	Frequency	Percent
No Response	1	0.6
Baby Boomer Born 1946 - 1964	7	4.4
Generation Xer Born 1965 - 1977	17	10.6
Generation Yer Born 1978 - 1999	135	84.4
Total	160	100.0

The demographic information shown in tables 1 – 8 reflect the majority of the population of respondents being Caucasian (95%), not married (88.1%), having no children (79.4%), generation classification (84.4), and age 18 – 23 (74.4%). The percentage of students from the perspective of age, marital status, generation classification, and number of children, represent the typical traditional college student. Gender, major, and academic class appear to have relatively diverse observations

included in the sample surveyed.

All surveys utilized a Likert Scale allowing measurement of work ethic and job interest related attributes. The Likert scale ranged from a Low of 1 to a High of 5.

Tables 9 – 11 show the questions and response descriptive frequency data.

Table 9 - Survey of Work Ethic and Job Interest at Work

	N	Min	Max	Mean	Std. Deviation
Pride in Work					
One who does a sloppy job at work should feel a little ashamed of oneself.	160	1	5	4.088	1.036
A worker should feel some responsibly to do a decent job, whether or not their supervisor is around.	160	2	5	4.581	0.609
There is nothing wrong with doing a poor job at work if one can get away with it	160	1	5	4.406	0.954
There is nothing as satisfying as doing the best job possible	160	1	5	4.406	0.973
One who feels no sense of pride in one's work is probably unhappy	160	1	5	3.669	1.114
Only a fool worries about doing a job well since it is important only that you do your job well enough to not get fired	160	1	5	4.500	0.861
One should feel a sense of pride in one's work	160	1	5	4.600	0.720
The most important thing about a job is liking the work	160	1	5	4.019	0.858
Doing a good job should mean as much to a worker as a good paycheck	160	1	5	4.138	0.865
Job Involvement					
Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously	160	1	5	2.906	1.355
One who has an idea about how to improve one's own job should drop a note in the company suggestion box	160	1	5	3.944	1.123
Activity Preference					
A job which requires the employee to be busy is better than a job which allows a lot of loafing	160	1	5	3.856	1.002
If a person can get away with it that person should try to work just a little less than the boss expects	160	1	5	4.181	1.045
The best job that a worker can get is one that requires very little work	160	0.3	5	4.067	1.007
When an employee can get away with it, the employee should take it easy	160	1	5	4.113	0.984
A person would soon grow tired of loafing on a job and would probably be happier if he or she worked hard	160	1	5	3.781	0.956

A person should try to stay busy all day rather than try to find ways to get out of doing work	160	1	5	4.356	0.704
Attitude Toward Earnings					
A person should choose the job that pays the most	160	1	5	2.956	1.012
A person should choose one job over another mostly because of the higher wages	160	1	5	2.988	0.978
The only important part of most jobs is my paycheck	160	1	5	3.525	1.064
Social Status on the Job					
One of the reasons that I work is to make my family respect me	160	1	5	3.188	1.520
Having a good job makes a person more worthy of praise from friends and family	160	1	5	3.231	1.204
Those who hold down good jobs are respected in society	160	1	5	4.050	0.957
Upward Striving					
Even if a person has a good job, the person should always be looking for a better job	160	1	5	2.700	1.196
One should always be thinking about pulling oneself up at work and should work hard with the hope of being promoted to a higher level job	160	1	5	4.231	0.885
A promotion to a higher-level job usually means more worried and should be avoided for that reason	160	0	5	4.100	0.892

Table 10 - Survey of Work Ethic and Job Interest at School

	N	Min	Max	Mean	Std. Deviation
Pride In Work					
One who does a sloppy job at school should feel a little ashamed of oneself	160	0	5	3.781	1.267
A student should feel some responsibly to do decent work, whether or not it is graded	160	0	5	4.188	0.933
There is nothing wrong with poor performance in class if one can get away with it	160	0	5	4.275	0.951
There is nothing as satisfying as doing the best you can at school	160	0	5	4.200	1.014
One who feels no sense of pride in one's school work is probably unhappy	160	0	5	3.400	1.193
Only a fool worries about getting A's, since C's are all that's needed to graduate	160	0	5	4.344	1.064
One should feel a sense of pride in one's work	160	0	5	4.544	0.800
The most important thing about a class is liking the subject	160	0	5	2.788	1.124
Doing good work should mean as much to a student as getting good grades	159	0	5	4.208	0.921
Job involvement					
Most colleges have student evaluations of faculty, but I doubt that this college takes these evaluations seriously	160	0	5	2.431	1.185

One who has an idea about how to improve one's classes should write their ideas on the faculty evaluation comments	160	0	5	3.925	1.055
Activity Preference					
An educational curriculum which requires the student to be busy is better than one which allows a lot of loafing	160	0	5	3.663	1.033
If a person can get away with it, that person should try to work just a little less than their teacher expects.	160	0	5	4.100	0.998
The best class that a student can get is one that requires very little work	159	0	5	3.767	1.176
When an student can get away with it in their program, the student should take it easy and not work too-hard	160	0	5	3.888	1.022
A person would soon grow tired of loafing at college and would probably be happier if he or she worked hard	159	0	5	3.748	1.085
A student should try to stay busy all day rather than try to find ways to get out of doing class work	160	0	5	3.869	1.029
Attitude Toward Earnings					
A student should choose the classes that give the best grades	160	0	5	3.475	1.028
A student should choose one class section over another mostly because of the opportunity of higher grades	160	0	5	3.344	1.144
The only important part of college is grades	160	0	5	3.694	1.155
Upward Striving					
Even if a student has good grades, the student should always be looking to improve their performance	160	0	5	4.369	0.806
One should always be thinking about pulling oneself up at college and should work hard with the hope of graduating with honors	160	0	5	4.425	0.797
Accepting extra work from a teacher means more worries and should be avoided for that reason	160	0	5	3.719	1.156

Table 11 - Survey of Work Ethic and Job Interest at Academic Organization and Job

Pride in Work	N	Min	Max	Mean	Std. Deviation
One who does a sloppy job at work should feel a little ashamed of oneself.	160	1	5	4.019	1.096
A worker should feel some responsibility to do a decent job whether or not their supervisor is around.	160	1	5	4.281	0.778
There is nothing wrong with doing a poor job at work if one can get away with it	160	1	5	4.231	0.940

There is nothing as satisfying as doing the best job possible	160	0	5	4.188	1.017
One who feels no sense of pride in one's work is probably unhappy	159	1	5	3.503	1.152
Only a fool worries about doing a job well since it is important only that you do your job well enough to not get fired	160	1	5	4.188	1.023
One should feel a sense of pride in one's work	160	0	5	4.406	0.878
The most important thing about a job is liking the work	160	0	5	3.806	0.994
Doing a good job should mean as much to a worker as a good paycheck	160	0	5	1.906	0.970
- Job Involvement					
Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously	160	0	5	2.669	1.169
One who has an idea about how to improve one's own job should drop a note in the company suggestion box	160	0	5	3.988	1.022
Activity Preference					
A job which requires the employee to be busy is better than a job which allows a lot of loafing	160	0	5	3.856	0.990
If a person can get away with it that person should try to work just a little less than the boss expects	160	0	5	4.175	0.929
The best job that a worker can get is one that requires very little work	159	0	5	3.868	1.032
When an employee can get away with it, the employee should take it easy	160	0	5	3.988	1.003
A person would soon grow tired of loafing on a job and would probably be happier if he or she worked hard	160	0	5	3.750	1.093
A person should try to stay busy all day rather than try to find ways to get out of doing work	160	0	5	3.963	1.002
Attitude Toward Earnings					
A person should choose the job that pays the most	160	0	5	3.038	1.075
A person should choose one job over another mostly because of the higher wages	160	0	5	2.956	1.189
The only important part of most jobs is my paycheck	160	0	5	3.400	1.167
Social Status on the Job					
The reason I work/attend college is to make my family respect me	160	0	5	3.138	1.276
Having a job/education makes one more \worthy of praise from friends and family	160	0	5	3.344	1.219
Those with a job / education are respected in society	160	0	5	3.994	1.061

Upward Striving					
Even with good grades / job, one should always be looking to improve	160	0	5	4.531	2.480
One should always be thinking about improving in hope of attaining a higher-level	160	0	5	4.344	0.825
Attempting extra work means more worries and should be avoided	160	0	5	3.800	1.103

The results of the test for hypothesis 1, “*Students place a high degree of importance on values and factors related to hard work and diligence in post academic work*” were taken from the results provided in table 9 shown in Table 12, as well as the statistical summary shown in Table 12A below:

Table 12 - Summary of Work Ethic and Job Interest Attributes – Post Academic

	Mean	Std Dev
Pride in Work	4.3	0.9
Activity Preference	4.1	0.9
Upward Striving	3.7	1.0
Job Involvement	3.5	2.2
Social Status on the Job	3.5	1.9
Attitude Toward Earnings	3.2	1.0
Average all Attributes	3.7	1.3

Table12A - Binomial Test of Work Ethic and Job Interest at Work

	Category	N	Observed Prop.	Test Prop.	P value
Pride in Work					
One who does a sloppy job at work should feel a little ashamed of oneself.	Group 1 <= 3	30	0.19	0.50	.000(a)
	Group 2 > 3	130	0.81		
	Total	160	1.00		
A worker should feel some responsibly to do a decent job, whether or not their supervisor is around.	Group 1 <= 3	4	0.03	0.50	.000(a)
	Group 2 > 3	156	0.98		
	Total	160	1.00		
There is nothing wrong with doing a poor job at work if one can get away with it	Group 1 <= 3	18	0.11	0.50	.000(a)
	Group 2 > 3	142	0.89		
	Total	160	1.00		
There is nothing as satisfying as doing the best job possible	Group 1 <= 3	20	0.13	0.50	.000(a)
	Group 2 > 3	140	0.88		

	Total		160	1.00		
One who feels no sense of pride in one's work is probably unhappy	Group 1	<= 3	67	0.42	0.50	.048(a)
	Group 2	> 3	93	0.58		
	Total		160	1.00		
Only a fool worries about doing a job well since it is important only that you do your job well enough to not get fired	Group 1	<= 3	16	0.10	0.50	.000(a)
	Group 2	> 3	144	0.90		
	Total		160	1.00		
One should feel a sense of pride in one's work	Group 1	<= 3	10	0.06	0.50	.000(a)
	Group 2	> 3	150	0.94		
	Total		160	1.00		
The most important thing about a job is liking the work	Group 1	<= 3	48	0.30	0.50	.000(a)
	Group 2	> 3	112	0.70		
	Total		160	1.00		
Doing a good job should mean as much to a worker as a good paycheck	Group 1	<= 3	26	0.16	0.50	.000(a)
	Group 2	> 3	134	0.84		
	Total		160	1.00		
Job Involvement						
Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously	Group 1	<= 3	121	0.76	0.50	.000(a)
	Group 2	> 3	39	0.24		
	Total		160	1.00		
One who has an idea about how to improve one's own job should drop a note in the company suggestion box	Group 1	<= 3	43	0.27	0.50	.000(a)
	Group 2	> 3	117	0.73		
	Total		160	1.00		
Activity Preference						
A job which requires the employee to be busy is better than a job which allows a lot of loafing	Group 1	<= 3	50	0.31	0.50	.000(a)
	Group 2	> 3	110	0.69		
	Total		160	1.00		
If a person can get away with it that person should try to work just a little less than the boss expects	Group 1	<= 3	29	0.18	0.50	.000(a)
	Group 2	> 3	131	0.82		
	Total		160	1.00		
The best job that a worker can get is one that requires very little	Group 1	<= 3	48	0.30	0.50	.000(a)
	Group 2	> 3	112	0.70		

work	Total		160	1.00		
When an employee can get away with it, the employee should take it easy	Group 1	<= 3	35	0.22	0.50	.000(a)
	Group 2	> 3	125	0.78		
	Total		160	1.00		
A person would soon grow tired of loafing on a job and would probably be happier if he or she worked hard	Group 1	<= 3	43	0.27	0.50	.000(a)
	Group 2	> 3	117	0.73		
	Total		160	1.00		
A person should try to stay busy all day rather than try to find ways to get out of doing work	Group 1	<= 3	16	0.10	0.50	.000(a)
	Group 2	> 3	144	0.90		
	Total		160	1.00		
Attitude Toward Earnings						
A person should choose the job that pays the most	Group 1	<= 3	118	0.74	0.50	.000(a)
	Group 2	> 3	42	0.26		
	Total		160	1.00		
A person should choose one job over another mostly because of the higher wages	Group 1	<= 3	118	0.74	0.50	.000(a)
	Group 2	> 3	42	0.26		
	Total		160	1.00		
The only important part of most jobs is my paycheck	Group 1	<= 3	78	0.49	0.50	.813(a)
	Group 2	> 3	82	0.51		
	Total		160	1.00		
Social Status on the Job						
One of the reasons that I work is to make my family respect me	Group 1	<= 3	109	0.68	0.50	.000(a)
	Group 2	> 3	51	0.32		
	Total		160	1.00		
Having a good job makes a person more worthy of praise from friends and family	Group 1	<= 3	89	0.56	0.50	.179(a)
	Group 2	> 3	71	0.44		
	Total		160	1.00		
Those who hold down good jobs are respected in society	Group 1	<= 3	35	0.22	0.50	.000(a)
	Group 2	> 3	125	0.78		
	Total		160	1.00		
Upward Striving						
Even if a person has a good job, the person	Group 1	<= 3	123	0.77	0.50	.000(a)

should always be looking for a better job	Group 2	> 3	37	0.23		
	Total		160	1.00		
One should always be thinking about pulling oneself up at work and should work hard with the hope of being promoted to a higher level job	Group 1	<= 3	26	0.16	0.50	.000(a)
	Group 2	> 3	134	0.84		
	Total		160	1.00		
	Group 1	<= 3	36	0.23	0.50	.000(a)
A promotion to a higher-level job usually means more worried and should be avoided for that reason	Group 2	> 3	121	0.77		
	Total		157	1.00		

a. Based on Z Approximation.

Note that data was recorded for all questions (in all tables) which requested the students' perception on a negative scale. For example, the statement, "There is nothing wrong with doing a poor job at work if one can get away with it" would show a strong work ethic if answered with a Low (1) response. Questions of this type were recorded to be consistent with the majority of questions where a "High" (5) response shows ethical work habits.

The descriptive statistics of the Binomial test for Work Ethic and Job Interest found in Table 12A indicate that 25 of the 26 p values of the variables tested were below as significance level of .05. This indicates sufficient data to reject the normality assumption for the 25 variables. Nonparametric Binomial testing was conducted on the data due to the rejected normality assumption of the 25 variables. 21 of the 26 variables tested were over the Likert scale value of 3 (midpoint between High and Low) suggesting strong work ethic and job interest were measured. The strength of the measurement over the midpoint is indicated in Table 12. The findings show an average of 3.7 (on a scale of 1 low, 5 high) measuring perceived student work ethic and job interest in their post academic job careers. While this is .7 higher than the middle of the scale, all attributes

averaged above the midrange. While the data in Table 12A shows 6 variables in which the majority of the responses were equal to the midpoint or lower, the average of these attributes indicates many of the data points were either equal to the midpoint or the responses observed over the midpoint were substantially higher than the midpoint. It should be noted Pride in Work, Activity Preference, and Upward Striving were the strongest work ethic attributes toward post academic work from students. This indicates student high regard for pride in the work they conduct, their intent to participate actively in their job at a high level, and their desire to move up within the organization. It should also be noted that Job Involvement, Social Status on the Job, and Attitude toward Earnings scored lower.

Considering 21 of the 26 variables measured showed a measurement over the midpoint on the Likert scale, the overall average of all attributes measure 3.7, and all individual attributes measure over the midpoint on average, there is insufficient evidence to conclude from testing of hypothesis 1 that students do not place a high degree of importance on values and factors related to hard work and diligence in post academic work.

The results of the test for hypothesis 2, “*Students place a high degree of importance on values and factors related to hard work and diligence in academic work*” were taken from the results provided in table 10 shown in Table 13, as well as the statistical summary shown in Table 13A below:

Table 13 - Summary of Work Ethic and Job Interest Attributes - Academic	Mean	Std Dev
Upward Striving	4.2	0.9
Pride In Work	4.0	1.0
Activity Preference	3.8	1.1
Attitude Toward Earnings	3.5	1.1
Job involvement	2.8	1.1
Average all Attributes	3.7	1.0

Table13A - Binomial Test of Work Ethic and Job Interest at School

	Category	N	Observed Prop.	Test Prop.	p value
Pride In Work					
One who does a sloppy job at school should feel a little ashamed of oneself	Group 1				
	<= 3	47	0.29	0.50	.000(a)
	Group 2 > 3	113	0.71		
	Total	160	1.00		
A student should feel some responsibly to do decent work, whether or not it is graded	Group 1				
	<= 3	20	0.13	0.50	.000(a)
	Group 2 > 3	140	0.88		
	Total	160	1.00		
There is nothing wrong with poor performance in class if one can get away with it	Group 1				
	<= 3	25	0.16	0.50	.000(a)
	Group 2 > 3	134	0.84		
	Total	159	1.00		
There is nothing as satisfying as doing the best you can at school	Group 1				
	<= 3	27	0.17	0.50	.000(a)
	Group 2 > 3	133	0.83		
	Total	160	1.00		
One who feels no sense of pride in one's school work is probably unhappy	Group 1				
	<= 3	84	0.53	0.50	.580(a)
	Group 2 > 3	76	0.48		
	Total	160	1.00		
Only a fool worries about getting A's, since C's are all that's needed to graduate	Group 1				
	<= 3	28	0.18	0.50	.000(a)
	Group 2 > 3	131	0.82		
	Total	159	1.00		
One should feel a sense of pride in one's work	Group 1				
	<= 3	14	0.09	0.50	.000(a)
	Group 2 > 3	146	0.91		
	Total	160	1.00		
The most important thing about a class is liking the subject	Group 1				
	<= 3	122	0.77	0.50	.000(a)
	Group 2 > 3	37	0.23		
	Total	159	1.00		
Doing good work should mean as much to a student as getting good grades	Group 1				
	<= 3	25	0.16	0.50	.000(a)
	Group 2 > 3	134	0.84		
	Total	159	1.00		
Job involvement					

Most colleges have student evaluations of faculty, but I doubt that this college takes these evaluations seriously	Group 1				
	<= 3	78	0.49	0.50	.874(a)
	Group 2 > 3				
		81	0.51		
	Total				
		159	1.00		
One who has an idea about how to improve one's classes should write their ideas on the faculty evaluation comments	Group 1				
	<= 3	145	0.91	0.50	.000(a)
	Group 2 > 3				
		14	0.09		
	Total				
		159	1.00		
Activity Preference					
An educational curriculum which requires the student to be busy is better than one which allows a lot of loafing	Group 1				
	<= 3	62	0.39	0.50	.005(a)
	Group 2 > 3				
		98	0.61		
	Total				
		160	1.00		
If a person can get away with it, that person should try to work just a little less than their teacher expects.	Group 1				
	<= 3	32	0.20	0.50	.000(a)
	Group 2 > 3				
		126	0.80		
	Total				
		158	1.00		
The best class that a student can get is one that requires very little work	Group 1				
	<= 3	56	0.36	0.50	.000(a)
	Group 2 > 3				
		101	0.64		
	Total				
		157	1.00		
When an student can get away with it in their program, the student should take it easy and not work too-hard	Group 1				
	<= 3	44	0.28	0.50	.000(a)
	Group 2 > 3				
		115	0.72		
	Total				
		159	1.00		
A person would soon grow tired of loafing at college and would probably be happier if he or she worked hard	Group 1				
	<= 3	49	0.31	0.50	.000(a)
	Group 2 > 3				
		110	0.69		
	Total				
		159	1.00		
A student should try to stay busy all day rather than try	Group 1				
	<= 3	50	0.31	0.50	.000(a)

to find ways to get out of doing class work	Group 2 > 3	110	0.69		
	Total	160	1.00		
Attitude Toward Earnings					
A student should choose the classes that give the best grades	Group 1 <= 3	88	0.55	0.50	.204(a)
	Group 2 > 3	71	0.45		
	Total	159	1.00		
A student should choose one class section over another mostly because of the opportunity of higher grades	Group 1 <= 3	92	0.58	0.50	.057(a)
	Group 2 > 3	67	0.42		
	Total	159	1.00		
The only important part of college is grades	Group 1 <= 3	60	0.38	0.50	.002(a)
	Group 2 > 3	99	0.62		
	Total	159	1.00		
Upward Striving					
Even if a student has good grades, the student should always be looking to improve their performance	Group 1 <= 3	13	0.08	0.50	.000(a)
	Group 2 > 3	147	0.92		
	Total	160	1.00		
One should always be thinking about pulling oneself up at college and should work hard with the hope of graduating with honors	Group 1 <= 3	11	0.07	0.50	.000(a)
	Group 2 > 3	149	0.93		
	Total	160	1.00		
Accepting extra work from a teacher means more worries and should be avoided for that reason	Group 1 <= 3	64	0.40	0.50	.017(a)
	Group 2 > 3	95	0.60		
	Total	159	1.00		

The descriptive statistics of the Binomial test for Work Ethic and Job Interest found in Table 13A indicate that 19 of the 23 p values of the variables tested were below as significance level of .05. This indicates sufficient data to reject the normality assumption for the 23 variables. Nonparametric Binomial testing was conducted on the

data due to the rejected normality assumption of the 23 variables. 18 of the 23 variables tested were over the Likert scale value of 3 (midpoint between High and Low) suggesting strong work ethic and job interest were measured for academic work. The strength of the measurement over the midpoint is indicated in Table 13. The findings show an average of 3.7 (on a scale of 1 low, 5 high) measuring perceived student work ethic and job interest in their academic work. While this is .7 higher than the middle of the scale, all attributes averaged above the midrange. While the data in Table 13A shows 5 variables in which the majority of the responses were equal to the midpoint or lower, the average of these attributes indicates many of the data points were either equal to the midpoint or the responses observed over the midpoint were substantially higher than the midpoint. It should be noted Pride in Work, Activity Preference, and Upward Striving were the strongest work ethic attributes toward academic work from students. This indicates student high regard for pride in the work they conduct, their intent to participate actively in their school work at a high level, and their desire to improve their school work or graduate with honors. It should also be noted that Job Involvement, and Attitude toward Earnings scored lower. It should also be noted all variables tested showed identical results to those tested for hypothesis 1 with the exception of Social Status on the Job which was not tested in part 2 of the survey.

Considering 18 of the 23 variables measured showed a measurement over the midpoint on the Likert scale, the overall average of all attributes measure 3.7, and all individual attributes measure over the midpoint on average, there is insufficient evidence to conclude from testing of hypothesis 2 that students do not place a high degree of importance on values and factors related to hard work and diligence in academic work.

The results of the test for hypothesis 3, "*Students place a high degree of*

importance on values and factors related to hard work and diligence in combined academic and post academic work” were taken from the results provided in table 11 shown in Table 14, as well as the statistical summary shown in Table 14A below:

Table 11 - Survey of Work Ethic and Job Interest at Academic Organization and Job

Pride in Work	N	Min	Max	Mean	Std. Deviation
One who does a sloppy job at work should feel a little ashamed of oneself.	160	1	5	4.019	1.096
A worker should feel some responsibly to do a decent job whether or not their supervisor is around.	160	1	5	4.281	0.778
There is nothing wrong with doing a poor job at work if one can get away with it	160	1	5	4.231	0.940
There is nothing as satisfying as doing the best job possible	160	0	5	4.188	1.017
One who feels no sense of pride in one's work is probably unhappy	159	1	5	3.503	1.152
Only a fool worries about doing a job well since it is important only that you do your job well enough to not get fired	160	1	5	4.188	1.023
One should feel a sense of pride in one's work	160	0	5	4.406	0.878
The most important thing about a job is liking the work	160	0	5	3.806	0.994
Doing a good job should mean as much to a worker as a good paycheck	160	0	5	1.906	0.970
• Job Involvement					
Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously	160	0	5	2.669	1.169
One who has an idea about how to improve one's own job should drop a note in the company suggestion box	160	0	5	3.988	1.022
Activity Preference					
A job which requires the employee to be busy is better than a job which allows a lot of loafing	160	0	5	3.856	0.990
If a person can get away with it that person should try to work just a little less than the boss expects	160	0	5	4.175	0.929
The best job that a worker can get is one that requires very little work	159	0	5	3.868	1.032
When an employee can get away with it, the employee should take it easy	160	0	5	3.988	1.003
A person would soon grow tired of loafing on a job and would probably be happier if he or she worked hard	160	0	5	3.750	1.093

A person should try to stay busy all day rather than try to find ways to get out of doing work	160	0	5	3.963	1.002
Attitude Toward Earnings					
A person should choose the job that pays the most	160	0	5	3.038	1.075
A person should choose one job over another mostly because of the higher wages	160	0	5	2.956	1.189
The only important part of most jobs is my paycheck	160	0	5	3.400	1.167
Social Status on the Job					
The reason I work/attend college is to make my family respect me	160	0	5	3.138	1.276
Having a job/education makes one more \worthy of praise from friends and family	160	0	5	3.344	1.219
Those with a job / education are respected in society	160	0	5	3.994	1.061
Upward Striving					
Even with good grades / job, one should always be looking to improve	160	0	34	4.531	2.480
One should always be thinking about improving in hope of attaining a higher-level	160	0	5	4.344	0.825
Attempting extra work means more worries and should be avoided	160	0	5	3.800	1.103

Table14A - Binomial Test of Work Ethic and Job Interest Attributes

		Category	N	Observed Prop.	Test Prop.	p value
Pride in Work						
One who does a sloppy job at work should feel a little ashamed of oneself.	Group 1	<= 3	36	0.23	0.50	.000(a)
	Group 2	> 3	124	0.78		
	Total		160	1.00		
A worker should feel some responsibly to do a decent job whether or not their supervisor is around.	Group 1	<= 3	21	0.13	1	.000(a)
	Group 2	> 3	139	0.87		
	Total		160	1.00		
There is nothing wrong with doing a poor job at work if one can get away with it	Group 1	<= 3	25	0.16	1	.000(a)
	Group 2	> 3	135	0.84		
	Total		160	1.00		
There is nothing as satisfying as doing the best job possible	Group 1	<= 3	28	0.18	1	.000(a)
	Group 2	> 3	132	0.83		
	Total		160	1.00		
One who feels no sense of pride in one's work is probably unhappy	Group 1	<= 3	76	0.48	1	.634(a)
	Group 2	> 3	83	0.52		
	Total		159	1.00		
Only a fool worries about doing a job well since it is important only that you do your job well enough to not	Group 1	<= 3	29	0.18	1	.000(a)
	Group 2	> 3	131	0.82		

get fired	Total		160	1.00		
One should feel a sense of pride in one's work	Group 1	<= 3	18	0.11	1	.000(a)
	Group 2	> 3	142	0.89		
	Total		160	1.00		
The most important thing about a job is liking the work	Group 1	<= 3	148	0.93	1	.000(a)
	Group 2	> 3	11	0.07		
	Total		159	1.00		
Doing a good job should mean as much to a worker as a good paycheck	Group 1	<= 3	34	0.21	1	.000(a)
	Group 2	> 3	126	0.79		
	Total		160	1.00		
• Job Involvement						
Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously	Group 1	<= 3	96	0.60	1	.011(a)
	Group 2	> 3	63	0.40		
	Total		159	1.00		
One who has an idea about how to improve one's own job should drop a note in the company suggestion box	Group 1	<= 3	46	0.29	1	.000(a)
	Group 2	> 3	114	0.71		
	Total		160	1.00		
Activity Preference						
A job which requires the employee to be busy is better than a job which allows a lot of loafing	Group 1	<= 3	48	0.30	1	.000(a)
	Group 2	> 3	112	0.70		
	Total		160	1.00		
If a person can get away with it that person should try to work just a little less than the boss expects	Group 1	<= 3	29	0.18	1	.000(a)
	Group 2	> 3	130	0.82		
	Total		159	1.00		
The best job that a worker can get is one that requires very little work	Group 1	<= 3	55	0.35	1	.000(a)
	Group 2	> 3	103	0.65		
	Total		158	1.00		
When an employee can get away with it, the employee should take it easy	Group 1	<= 3	39	0.25	1	.000(a)
	Group 2	> 3	120	0.75		
	Total		159	1.00		
A person would soon grow tired of loafing on a job and would probably be happier if he or she worked hard	Group 1	<= 3	52	0.33	1	.000(a)
	Group 2	> 3	108	0.68		
	Total		160	1.00		
A person should try to stay busy all day rather than try to find ways to get out of doing work	Group 1	<= 3	38	0.24	1	.000(a)
	Group 2	> 3	122	0.76		
	Total		160	1.00		
Attitude Toward Earnings						
A person should choose the job that pays the most	Group 1	<= 3	114	0.72	1	.000(a)
	Group 2	> 3	45	0.28		

	Total		159	1.00		
A person should choose one job over another mostly because of the higher wages	Group 1	<= 3	109	0.69	1	.000(a)
	Group 2	> 3	50	0.31		
	Total		159	1.00		
The only important part of most jobs is my paycheck	Group 1	<= 3	87	0.55	1	.267(a)
	Group 2	> 3	72	0.45		
	Total		159	1.00		
Social Status on the Job						
The reason I work/attend college is to make my family respect me	Group 1	<= 3	104	0.65	1	.000(a)
	Group 2	> 3	56	0.35		
	Total		160	1.00		
Having a job/education makes one more \worthy of praise from friends and family	Group 1	<= 3	79	0.49	1	.937(a)
	Group 2	> 3	81	0.51		
	Total		160	1.00		
Those with a job / education are respected in society	Group 1	<= 3	39	0.24	1	.000(a)
	Group 2	> 3	121	0.76		
	Total		160	1.00		
Upward Striving						
Even with good grades / job, one should always be looking to improve	Group 1	<= 3	18	0.11	1	.000(a)
	Group 2	> 3	142	0.89		
	Total		160	1.00		
One should always be thinking about improving in hope of attaining a higher-level	Group 1	<= 3	16	0.10	1	.000(a)
	Group 2	> 3	144	0.90		
	Total		160	1.00		
Attempting extra work means more worries and should be avoided	Group 1	<= 3	52	0.33	1	.000(a)
	Group 2	> 3	107	0.67		
	Total		159	1.00		

The descriptive statistics of the Binomial test for Work Ethic and Job Interest found in Table 14A indicate that 23 of the 26 p values of the variables tested were below as significance level of .05. This indicates sufficient data to reject the normality assumption for the 23 variables. Nonparametric Binomial testing was conducted on the data due to the rejected normality assumption of the 23 variables. 21 of the 26 variables tested were over the Likert scale value of 3 (midpoint between High and Low) suggesting strong work ethic and job interest were measured. The strength of the measurement over

the midpoint is indicated in Table 14. The findings show an average of 3.7 (on a scale of 1 low, 5 high) measuring perceived student work ethic and job interest in their post academic job careers. While this is .7 higher than the middle of the scale, all attributes averaged above the midrange. While the data in Table 14A shows 5 variables in which the majority of the responses were equal to the midpoint or lower, the average of these attributes indicates many of the data points were either equal to the midpoint or the responses observed over the midpoint were substantially higher than the midpoint. It should be noted Pride in Work, Activity Preference, and Upward Striving were the strongest work ethic attributes toward post academic work from students. This indicates student high regard for pride in the work they conduct, their intent to participate actively in their job at a high level, and their desire to move up within the organization. It should also be noted that Job Involvement, Social Status on the Job, and Attitude toward Earnings scored lower. These results were identical to the results of the test for hypothesis 1.

Considering 21 of the 26 variables measured showed a measurement over the midpoint on the Likert scale, the overall average of all attributes measure 3.7, and all individual attributes measure over the midpoint on average, there is insufficient evidence to conclude from testing of hypothesis 3 that students do not place a high degree of importance on values and factors related to hard work and diligence in combined academic and post academic work.

Hypothesis 4 and 5 tested the ethical perceptions of students. For the purpose of testing hypothesis 4 and 5, each question was coded in association with the nature of the question. The codes Ethical, Not Ethical, In for Money, Respect, Loyalty, and Info were used. The coding took place after the survey was conducted with the students and

students were not privy to the coding. Standard deviations for all responses were below 1.28 with the exception of three questions only one of which was coded as ethical or unethical. The referenced question came from part 3 (table 11) which read, “Even with good grades / job, one should always be looking to improve” and was measured at 4.5 (indicating students felt strong work ethic) with a standard deviation of 2.4. Considering the overall standard deviations, results as measured by responses in the data appears to be reliable.

The test for hypothesis 4, *Student perceptions favor strong ethical values when placed in situations impacting ethical dilemmas*, was conducted by studying the 32 questions coded as ethical considerations combined from all three tables. The overall rating for all questions combined coded as an ethical question 4.09 which is .91 from the top of the Likert scale of “Highly Ethical” for these questions. The standard deviation for this test was 1.08 indicating relatively high degree of reliability. This indicates the attitude of the student population toward academic performance and job performance from a work ethic standpoint was relatively high in regard to high ethics. Considering the results of the test, there is insufficient evidence to conclude from testing of hypothesis 4 that students do not favor strong ethical values when placed in situations impacting ethical dilemmas.

The test for hypothesis 5, *Student perceptions favor strong ethical values when placed in situations impacting unethical dilemma* was conducted by studying the 23 questions coded as unethical considerations combined from all three tables. The overall rating for all questions combined coded as an unethical question was 2.09. The standard deviation for the test was 1.10 indicating a relatively high degree of reliability in the data. While this average is closer to the low end of the Likert scale which would

indicate students work ethic toward unethical activity to be low, it should be noted the average is also .91 from the middle of the scale which would indicate students on the average felt indifferent as to whether unethical activity is low or high when measuring these unethical situations. Considering the results of the test, there is insufficient evidence to conclude from testing of hypothesis 5 that students do not favor strong ethical values when placed in situations impacting unethical dilemmas.

Other individual data elements of the survey reported the following observations. When asked, “The only important part of college is grades,” students responds averaged 1.16 indicating a low amount of agreement with the comment. Students rated the following questions between 2.43 and 2.67 indicating a mediocre measurement of work ethic:

- 1) Most colleges have student evaluations of faculty, but I doubt that this college takes these evaluations seriously
- 2) The only important part of most jobs is my paycheck
- 3) A student should choose the classes that give the best grades
- 4) The only important part of most jobs is my paycheck
- 5) A student should choose one class section over another mostly because of the opportunity of higher grades
- 6) Most companies have suggestion boxes for their workers but I doubt that the companies take these suggestions seriously

Data Statements

According to the evidence collected from testing of the hypotheses, the following statements can be made:

- Students place a high degree of importance on values and factors related to hard

work and diligence in post academic work

- Students place a high degree of importance on values and factors related to hard work and diligence in academic work
- Students place a high degree of importance on values and factors related to hard work and diligence in combined academic and post academic work
- Students favor strong ethical values when placed in situations impacting ethical dilemmas
- Students favor strong ethical values when placed in situations impacting unethical dilemmas

These statements indicate that students have a high regard for pride in the work they conduct, their intent to participate actively in their school work at a high level, and a desire to improve their school work or graduate with honors as it relates to their overall academic improvement, future economic and personal developmental gains.

Closing Implications

Since job satisfaction levels have been slipping since the 1970s (Fairlie, 2010), attitudes about work are also becoming worse and more people are not agreeing with the statement, “Work is a person’s most important activity.” Work is now seen, in many circles, as an activity that is beneficial only to “pay the bills” and something that “makes the boss rich but not me.” Students can be naturally displaced from their class work situations since they see no variety, control, feedback, recognition or significant impact on anything greater than themselves. When students, and eventually workers, analyze what they are “doing with their lives” in school and at work, they also desire to demand more meaning from the extensive time they spend in school and at work. The degree of importance for students and workers is measured by what ultimate gain they will achieve

from their work. As in economics, when the marginal gain no longer outweighs the marginal cost of their efforts, the student or worker will cease to make any meaningful efforts in their work and will either withdraw completely or have a strong desire to leave a job.

From the research presented, the strongest drivers of commitment and intentions (Fairlie, 2010) can be summarized by the following:

- Fulfilling a life purpose & Life happiness
- Ability to accomplish tasks outside of the class or work setting
- Positive impact on the world outside of the class or work setting

These drivers are shown to be equally important throughout generations but with a falling degree of importance on values and factors in order to achieve and a lack of practiced habits and traits related to hard work and diligence, the perception toward work as a contributing factor to success is minimized.

Students who don't feel that their work is meaningful will withdraw psychologically and put any other necessary energy into something else ("refocus their passion"). These students will do what is required of them in the classroom to "pass" that class and then go towards "their passion", which is what really matters to them. As shown through the research, educators can bring meaning to "the classroom" in the following ways (adapted from Fairlie, 2010):

- Help students realize where "their passion" should be focused earlier in the learning process
- Help students realize how meaningful their assignments are towards their ultimate goals
- Educators should share "meaningful" stories in the class ("What has been

meaningful about your chosen profession to you?”

- Take students’ suggestions on how to make the classroom more meaningful
- Enable educators to give more recognition to students
- Become open to organizational “redesign” for improving “meaningful” work

These improvements in the classroom can add more meaning to the learning environment and to the nature of work ethic in students’ lives. Every task given to students can have more “meaning” towards their ultimate goals thus ensuring a higher commitment, retention of students and eventually, a greater work ethic.

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THE EFFECT OF SELF-EFFICACY ON PERCEPTIONS OF STUDENT INTERNSHIP EFFECTIVENESS

ABSTRACT – RESEARCH PROPOSAL

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INTRODUCTION

For experiential learning as well as other areas of education, there is increasing interest in outcomes assessment and measurement. (Brodie, 2007; Costley, 2007, Gordon, 2002) One interesting question asks how much of the variance in assessment scores results from differences in the experiential learning activity versus the variance attributable to some other factor.

A one-month internship is available as an academic option during regular semesters and a January term at a nationally ranked liberal arts college. These students work full time for the month of January or part time for the entire semester, and they receive three-hours of academic credit. Although they work 130-160 hours or more during their internship, and are required to turn in supplemental reports to their faculty supervisors, the students receive no pay, nor do they expect to receive any pay. These student interns, therefore, are an invaluable sample allowing the researchers to study motivation, and not only control for the variable of pay, but eliminate it all together.

Following the internship, students respond to a multi part computer-based survey instrument. Data is gathered approximately one to two weeks following the completion of the internship. Interns provide an assessment of learning based on Gordon (2002) as well as measures of Growth Need Strength (Hackman & Oldham, 1980) and Self Efficacy (Sherere et al. 1982); a ranking of five potential expectations for their internship: *Relationship building with my supervisor*, *Experience in the industry*, *Potential for future employment with the company*, *Potential reference or referral for future employment*, and *Grade and/or academic credit*. The interns are also asked to respond in a short paragraph to two questions modified from Herzberg to be specific to the internship experience (Herzberg, 1959): "Briefly describe the most satisfying experience you encountered at work during your internship" and "Briefly describe the most dissatisfying experience you encountered at work during your internship."

HYPOTHESES AND METHOD

Design of the Current Study

The measures of Growth Need Strength and Self Efficacy will be scored by the researchers using the key provided with the scales. The rankings of expectation are used as provided by the interns. Data analysis will employ simple statistical methods including correlation analysis to test the relationships between Growth Need Strength and Self Efficacy, expectations from the internships, as well as perceptions of learning outcomes. Several preliminary hypotheses follow. Based on a previous student internship study, some expected outcomes are noted.

Hypothesis I: Rankings of Internship Expectations will be independent of Growth Need Strength.

Hypothesis II: Rankings of Internship Expectations will be independent of Self Efficacy.

Hypothesis III: Rankings of Internship Expectations will be independent of Gender.

Hypothesis IV: Learning Outcome Perceptions will be independent of Growth Need Strength.

Hypothesis V: Learning Outcome Perceptions will be independent of Self Efficacy.

Hypothesis VI: Learning Outcome Perceptions will be independent of Gender.

The data will be examined to explore the relationships between Growth Need Strength, Self Efficacy, internship expectations, and perceptions of learning outcomes, although as this is a preliminary study no additional formal hypotheses are presented.

CONCLUSIONS

A previous study in 2002-2003 resulted in student intern responses broadly consistent with Herzberg's theory of motivation although supervision and interpersonal relations emerged as a motivator rather than as a hygiene factor. Growth-need strength and self-efficacy did not emerge as highly correlated with expectations. The main emphasis in this study is on perceptions of learning outcomes and expectations and the correlation strength between outcomes and growth-need strength scores. Data has already been collected from over 100 interns and an expected 50 or more additional responses are expected to be added by the time the paper is finalized.

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CREATING AND DELIVERING FORMAL PRESENTATIONS IN A DISTANCE LEARNING CLASSROOM

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ABSTRACT

Online education has grown rapidly over the past 15 years. Classes which were originally delivered as a set of html templates are now delivered through full blown learning management systems such as WebCT, Blackboard, and Moodle. These integrated systems have been improved to allow for more ways of communication between all the participants: student to student, or between students and faculty. A task which has not been easy to accomplish is the creation and delivery of formal talks or presentations. Numerous studies have shown that employers rate student communication skills, both written and oral, as very important to choosing future employees. However, all too often, new graduates do not have these skills. This paper reports the results of a pilot study which incorporated a formal presentation into an online class. The paper concludes with lessons learned, and directions for future research.

Introduction

Course management systems, such as Blackboard, provide many tools to interact and assess students. Asynchronous tools include discussion forums and email, and the primary synchronous tool is through text-based chat. A text-based system is reasonable for question and answer sessions between students and professors, or for discussions with small groups. Students can easily upload papers which can test their written communication skills. However, the current systems do not easily allow for students to make formal research or case study presentations. The major goal of the current study was to provide students in an online class the necessary tools to give a formal oral presentation, including both presentation software and live audio.

The importance of presentations

Institutions such as ours have become more proactive in recent years in asking employers about their recent graduates. One of the questions is inevitably what skills they feel their new employees are lacking? Typically, either at the top of near the top of the list are communication skills, both written and oral. This local experience is supported by national studies of skills sought by employers [4] [5]. Across a variety of industries, oral communications skills have been identified as the most important skills to possess [3]. Ironically, however, oral communications is the area that employers identify as most in need of improvement [6]. In response, many top business schools have revamped their curricula, placing new emphasis on so-called “soft skills”

such as oral communication [1]. The University of Wisconsin has even considered using a dual transcript system which would include an assessment of soft skills along with course grades [2]. These kinds of changes, however, address communication skills only in traditional, face-to-face classroom settings. What about online classes?

In a typical online class, it is easy to assess written communication, through postings on the discussion forum, or individual assignments such as term papers which are emailed directly to the instructor, or posted for feedback from other students in the class. In fact, this type of communication is probably easier to assess than the traditional classroom, as all communication is documented and archived in one location.

Oral communication skills are a different story. As indicated earlier, most course management systems do not allow for the easy inclusion of oral presentations. This paper describes the authors' experience in having students make an oral presentation in an online class. In the remainder of the paper, results from the experience are presented, along with details of the exercise, and lessons learned by the instructors.

The Exercise

One of the authors has taught a class entitled Comparative Management in the traditional classroom for the past 15 years. A major component of the class has been an individual paper and presentation accounting for 25% of the class grade. For this project students are told that they are International Staff Experts for an international company which is considering expanding its production facilities to the country assigned them. The students are then to prepare both a written report and an oral presentation to the Board of Directors (i.e., the class), as to whether they recommend expansion into the assigned country. A set of guidelines and a rubric is given to the students as to how their oral presentations will be evaluated. Typical presentations are 10–15 minutes in length, depending on the class size. Thus, at least four 75-minute class periods are dedicated to the student reports with 30 students in the class.

In the summer of 2010, a request was made to offer the class online. Even though the instructor has been teaching online since 1996, this was seen as a challenge given the interactive nature of the traditional class design. The biggest challenge was to replicate the oral presentation. The instructor has been using Wimba, a web-based product which allows for multimedia communication, and is used as an add-on to Blackboard for our distance education program. In a typical Wimba session, the instructor and students log on to individual computers. The screen layout (from the student's perspective) is displayed in Figure 1.

Main Display Can contain video of instructor, PowerPoint slides, Word documents, etc.		Navigation pane Access to other content
Message area Includes chat entries from other participants	Input area Participants enter messages here, including text and symbols (e.g., hand icon to indicate a question)	

Figure 1 — Typical Wimba Session Layout (from Student’s Perspective)

Both audio and video capabilities are available for all users. However, for large groups we have used it in a “talking head” mode, where the instructor transmits audio and video which is heard and seen by the students, but the students are limited to text-based input from the keyboard. Input from individual students can be viewed by all participants. For example, the instructor has used Wimba for case discussions, with the instructor using the audio capabilities, and the students using the text box for responses. Limiting the speakers to one has been found to be very useful in that cross-conversations and interruptions are then eliminated. A tertiary analysis has found that the instructor is involved in communication around one-third of the time, thus making sense that he use the audio to make the conversation and discussion flow much quicker. Each discussion is then archived for further review by students if necessary.

Wimba also allows for virtually any electronic media to be “broadcast” during a session. For example, the instructor can display Microsoft Word or PowerPoint presentations in the video area while simultaneously discussing the content verbally. This has been nice feature when the instructor has “lectured” to the students. From these previous experiences, it seemed that Wimba would be a useful tool to allow students to make formal oral presentations.

Challenges which had to be overcome

To use Wimba, a couple of obstacles had to be overcome. First, since these were undergraduate students, who are very deadline oriented, explicit instructions had to be created as to how to access Wimba, how to upload a file, and how to archive the presentation. Second, the biggest issue was to find time for the presentations. The class was taught over an eight-week summer term, which had a dedicated hour per week for chat time. Traditionally chats have been set up like an office hour, allowing students to drop in when they had questions, rather than as a traditional class time which students were expected to attend. Either way, with a class size of 24 students, and a presentation length of 12 minutes, there was obviously a major shortage of time to make the presentations “live”. [To do live presentations, 24 x 12 or 6 hours would have been

needed assuming there were no glitches, and assuming 2 chat hours were dedicated, the available class time would have fallen far short.]

These obstacles were dealt with in the following manner. First, three weeks before the end of the term, detailed instructions were emailed to the students and posted to the class website on how to access Wimba, upload a presentation, create a presentation, and how to archive it. Students thus had plenty of time to practice, and ask questions if they had any. Even with 2 email reminders, this process failed miserably. Only one student practiced using the technology prior to the final week. For the second obstacle, the decision was made to have the students prerecord their presentations rather than present to a live audience. This was handled in the following manner. One week prior to the end of class, a schedule of appointments was sent to the students. Most of the students worked full time, and did not have free time during the day. I assigned each student an hour of time between 5-11PM from Monday to Thursday, giving them at least an hour to create a 12-minute presentation. If they could not make their dedicated time, they could use any other time throughout the day or night, as long as no other students were using the Wimba room (only one person could present at a time), and they completed the assignment by 7AM on Friday when all assignments were due. I then reviewed the presentations over the weekend to make my evaluations using the predetermined rubric, as I would have during a live traditional classroom presentation.

Results of the exercise

Undergraduate student behavior was the primary driver of the exercise results. First, as indicated earlier, only one out of 24 students actually took advantage of trying out the technology ahead of time. She had questions, which the instructor was able to quickly answer in our regularly scheduled chat time. Partially because of the complexity of the task, and since no requirement had been made before the actual presentation, students had all kinds of trouble delivering the presentation. Seven of the students gave up, or did not even try to do the presentation. Three of these emailed me their PowerPoint slides in hopes of getting partial credit. The other four simply took a zero for the oral portion of their grade. An additional 10 students, tried to create their presentation in Wimba during their scheduled time, but failed at various levels. A summary of these 10 follows: four successfully uploaded PowerPoint to Wimba, but got no further; four successfully uploaded and created/archived their presentations to Wimba, but failed to record an audio; the last two cut their archived presentations off before the conclusions. Thus in all 10 of these cases, these problems could have been solved with previous experience with the technology. The remaining seven students tried and successfully uploaded their presentations to Wimba. Thus, they were able to overcome technological obstacles, and I was able to use the rubric to evaluate their orals as if they delivered them in person in real time. It must be noted though, that even in the cases where students successfully recorded part or all of their presentations, they needed on average three “trials” before getting it right. In fact, one of the

final seven students, came back three times during “open time” to rerecord her presentation, as she had watched it, and was not satisfied with the original.

Suggestions from students and the instructor for future iterations of the exercise

Given the technical issues, is it worth pursuing this type of exercise? The definite answer is yes. Below are suggested improvements.

- 1) *Directions.* The instructor would give even more detailed directions, including screen shots. Students who were successful suggested three areas for improvement in the instructions. First, a screen shot of the button which is used to record the audio. This was the issue which students had the most trouble with. Second, a more detailed step by step set of instructions on how to upload their presentations. Third, an example of how to listen to their own presentations.
- 2) *Requirement on using the technology.* In this exercise, students were offered technical assistance and instructions beforehand. However, only 1 of 24 students anticipated the need for this help. Given that technical issues may often happen, and students tend to be very deadline driven, the instructor would a required assignment which would be due before the presentations were made to try and “flush out” any issues students may have.
- 3) *Watching and evaluation of the final presentations.* Because the assignment was made for the last week of the semester, only the instructor watched the final products. Other students did not to learn from the presentations made by their classmates. In the future, along with the recommendations made above, the instructor would have the assignment due before the last week of class, so that a peer review would be possible. Students could then learn from each other both about the specific countries and what makes a good presentation in terms of criteria within the rubric.
- 4) *Benchmarks.* Links to two of the better final products would be made available to students to see samples of the possibilities.

Conclusion

This exercise attempted to duplicate oral presentations presented in a traditional face-to-face classroom. Obstacles included capabilities of learning management systems (no audio), time (minimal synchronous time availability), technical (integrating and learning of new technologies), and behavioral (tendency of undergraduate students to be deadline oriented and not wanting to try new things.) Although these obstacles were anticipated beforehand, they still proved to be present, but not insurmountable. About one-third of the students were able to create a good final product, and with the suggestions made for the future, we feel we can come close to the success rate found in the traditional face-to-face classroom.

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A Comparison of How Professors in Various Disciplines Are Using WEB 2.0 Technologies in the Classroom

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Abstract

Many terms have been applied to today's students: Digital Natives, Generation Y, the Millennial Generation, Generation Next, the Net Generation, Nexters, Echo Boomers. These terms indicate the changing nature of today's student. These students are growing up using technologies most professors do not understand. It is imperative that today's professors learn to engage students using these technologies.

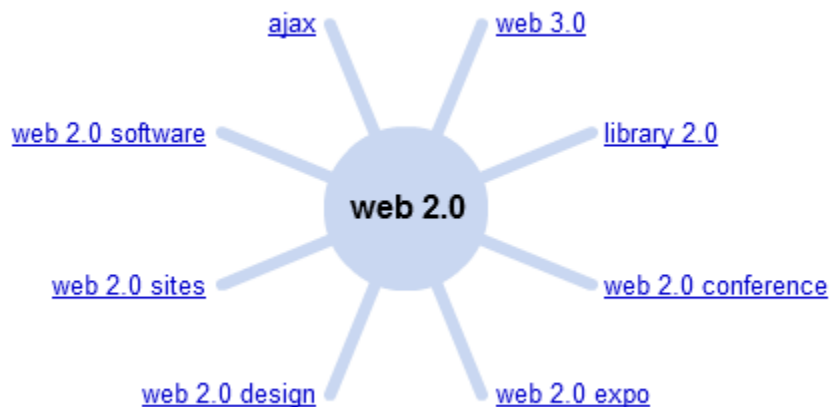
The term Web 2.0 refers to a change in the way we interact with sites on the World Wide Web. In the past, information was posted on Websites for one-way communication, viewing only. With Web 2.0 technologies we can begin interacting with Web content. Common Web 2.0 technologies include wikis, blogs, podcasts, social networks, YouTube, Second Life and others.

This research reports on how professors in technology disciplines are using Web 2.0 technologies. The findings indicate most professors are comfortable using Web 2.0 technologies.

Introduction

The term Web 2.0 was coined in 1999 by Darcy DiNucci in her article "Fragmented Future" some five years later, the term was commonly adopted as the Internet became increasingly used as an interactive platform. Activities such as posting thoughts on blogs and recording ideas as audio or video podcasts are at the heart of Web 2.0. Linking blogs to personal social networking sites and working collaboratively on wikis as part of classroom curriculum has become common place. Using the Google Wonder Wheel it is simple to track the evolution of ideas and concepts related to the term Web 2.0

Figure 1



Source: Google Search, Wonder Wheel, term - web 2.0, on 5/19/2010

Technologies are evolving rapidly, and it is difficult to keep up. For educators, simply knowing about them is not enough. Today's professors must learn how to use these technologies in the classroom to both engage students and enhance the educational experience.

This research compares how college professors in differing disciplines are doing in this.

Literature Review

There is no shortage of articles and books about the use of new technologies in higher education and many suggest ideas for implementing technologies in the classroom. While there are published case studies documenting the experiences of individual professors, none report on where we currently stand or discuss a roadmap to the classroom of the future.

Hypothesis

The basis of this study is an investigation of the knowledge, attitudes and select, specific uses of various World Wide Web technologies by college professors in the classroom. The specific Web 2.0 technologies investigated include some Web 1.0 and other technologies such as e-mail, instant messaging and the creation of Web pages for a baseline comparison. The Web 2.0 technologies investigated are social

networks, online document sharing, wikis, blogs, postings to YouTube, Second Life, calendar sites, really simple syndication (RSS) and bookmarking sites. Other technologies investigated include online course management tools such as Blackboard and MIT's OpenCourseWare.

The first set of questions ask professors about their knowledge of these technologies. The next set of questions asked about professors' attitudes towards the technologies and the third set of questions asked about use of these technologies for a specific set of instructional purposes. The instructional purposes were selected based on their general use and the applicability of the technologies examined.

These questions were combined into a set of matrixes on the questionnaire shown in Appendix 1.

H1: Professors in technology disciplines will have more knowledge of Web 2.0 tools than professors in other disciplines.

H2: Professors in technology disciplines will have more positive attitudes toward Web 2.0 tools than professors in other disciplines.

H3: Professors in technology disciplines will use more Web 2.0 tools than professors in other disciplines.

For this research, three topics from the questionnaire were selected as representing Web 2.0 technologies, social networking, wikis and blogging. Technology disciplines were defined as computer science, information systems, management information systems and others that focus primarily on computer use in professional settings.

Analysis

The Respondents

As shown in the following tables, the sample consists of a mix of faculty members. Most respondents were male between the ages of 30 and 50 and from a variety of disciplines. Most have more than 10 years experience in higher education.

Table 1 shows the rank of the respondents, 86% of which were faculty members.

Table 1

Position	Frequency	Valid Percent	Cumulative Percent
Dean	3	2.4	2.4
Assoc. Dean	1	.8	3.2
Asst. Dean	3	2.4	5.6
Prof	35	28.2	33.9
Assoc. Prof.	36	29.0	62.9
Asst. Prof.	31	25.0	87.9
Instructor	10	8.1	96.0
Other	5	4.0	100.0

Table 2 shows the age of the respondents, 80.6% were between the ages of 30 and 49.

Table 2

Age	Frequency	Valid Percent	Cumulative Percent
	2	1.6	1.6
Less than 30	4	3.2	4.8
30 – 39	29	23.4	28.2
40 – 49	30	24.2	52.4
50 – 59	40	32.3	84.7
60+	19	15.3	100.0

Table 3 shows the longevity in higher education of the respondents, 62.1% have more than 10 years experience.

Table 3

Years Higher Ed	Frequency	Valid Percent	Cumulative Percent
less than 3	14	11.3	12.9
4 – 6	17	13.7	26.6
7 – 9	14	11.3	37.9
10 +	77	62.1	100.0

Table 4 shows the gender of the respondents, 58.1% were male.

Table 4

Gender	Frequency	Valid Percent	Cumulative Percent
	1	.8	.8
Female	51	41.1	41.9
Male	72	58.1	100.0
Total	124	100.0	

Table 5 lists the respondent's discipline.

Table 5

Discipline	Frequency	Valid Percent	Cumulative Percent
Accounting	5	4.1	4.1
Art	1	.8	58.7

Athletics	1	.8	72.7
Biochemistry	1	.8	65.3
Biology	2	1.7	64.5
Chemistry	1	.8	66.1
Communications	4	3.3	45.5
Computer Science	3	2.5	83.5
Criminal Justice	1	.8	47.1
Curriculum	1	.8	73.6
Economics	1	.8	5.0
Education	6	5.0	78.5
Engineering	2	1.7	85.1
English	2	1.7	48.8
Finance	2	1.7	6.6
General Business	3	2.5	42.1
IST	1	.8	86.0
Journalism	5	4.1	52.9
Kinesiology	2	1.7	80.2
Languages	1	.8	53.7
Library	1	.8	100.0
Management	8	6.6	13.2
Marketing	1	.8	39.7
Math	6	5.0	71.1
Medicine	11	9.1	95.0
MIS	31	25.6	38.8
Music	4	3.3	62.0
Nursing	4	3.3	98.3
Psychology	5	4.1	57.0
Public Health	1	.8	99.2
Recreation	1	.8	81.0
Sociology	1	.8	57.9
Statistics	1	.8	71.9
Theatre	1	.8	62.8

Technology disciplines were defined based on this list: computer science, engineering, information systems, information technology, integrated science and technology, and management information systems.

Results

The hypotheses will now be analyzed. As stated earlier, for this research, three topics from the questionnaire were selected as representing Web 2.0 technologies: social networking, wikis and blogging. The responses to questions about each of these topics were analyzed.

Each hypothesis compares professors in technology disciplines to all others. A dummy variable was created with technology disciplines coded as 1 and all others coded as 2 to show this difference.

First, measures to examine the differences in demographics between the two groups are presented. Table 6 summarizes the two groups.

Table 6

		Tech	Non-Tech	
Percentage		31.50%	68.50%	
Count		39	85	Overall Chi-Square
Title	Dean	2	1	0.129
	Associate Dean	0	1	
	Assistant Dean	1	2	
	Professor	10	25	
	Associate Professor	11	25	
	Assistant Professor	8	23	
	Instructor	4	6	
	Other	3	2	
Age	No Response	0	2	0.236
	Less Than 30	3	1	
	30 To 39	12	17	
	40 To 49	9	21	
	50 To 59	10	30	
	60+	5	14	
Years Of Higher Education Experience	No Response	2	0	0.293
	> 3	4	10	
	3 To 6	6	11	
	7 To 9	5	9	
	10+	22	55	
Gender	No Response	0	1	0.792
	Female	16	35	
	Male	23	49	

While there are differences between the two groups, fewer than one third of the sample was made up of tech professors. The chi-square test results show no statistically significant differences between them on any of the demographic variables.

H1: Professor in technology disciplines will have more knowledge of Web 2.0 tools than professors in other disciplines.

Three questions from the knowledge section of the questionnaire were used.

What is your knowledge level for each of the following technologies? Social Networks (Facebook, MySpace, Twitter, etc.), wikis and blogs. The responses were measured on a Likert-type scale from no knowledge, have heard of it, can define it, can use it, can teach others to use it to expert. The results of the t-test are shown in Table 7.

Table 7

Variables	N	Mean	Std. Deviation	Std. Error Mean	t-value	df	Sig. (2-tailed)	
Social Networks	TECH	39	4.56	1.046	.168	3.505	122	.001
	Non-Tech	85	3.79	1.186	.129			
Wiki	TECH	39	4.41	1.186	.190	4.850	122	.000
	Non-Tech	85	3.16	1.387	.150			
Blogs	TECH	39	4.49	1.048	.168	4.399	122	.000
	Non-Tech	85	3.54	1.140	.124			

The results show support H1, professors in technology disciplines are more knowledgeable of Web 2.0 tools.

H2: Professors in technology disciplines will have more positive attitudes toward Web 2.0 tools than professors in other disciplines.

Three questions from the attitude section of the questionnaire were used.

1. What is your attitude toward using each of these technologies for instructional purposes? Social Networks (Facebook, MySpace, Twitter, etc.), wikis Blogs. The responses were measured on a Likert-type scale: very negative, negative, neutral / no opinion, positive, very positive. The results of the t-test are shown in Table 8.

Table 8

Variables	N	Mean	Std. Deviation	Std. Error Mean	t-value	df	Sig. (2-tailed)	
Social Networks	TECH	38	4.47	1.033	.168	2.150	122	.034
	Non-Tech	84	4.05	1.005	.110			
Wiki	TECH	38	5.13	.741	.120	5.513	122	.000
	Non-Tech	84	4.39	.659	.072			
Blogs	TECH	38	4.97	.854	.139	4.228	122	.000
	Non-Tech	83	4.27	.857	.094			

The results show support H2, professors in technology disciplines have higher positive attitudes toward Web 2.0 tools than professors in other disciplines.

H3: Professors in technology disciplines will use more Web 2.0 tools than professors in other disciplines.

Three questions from the use section of the questionnaire were used.

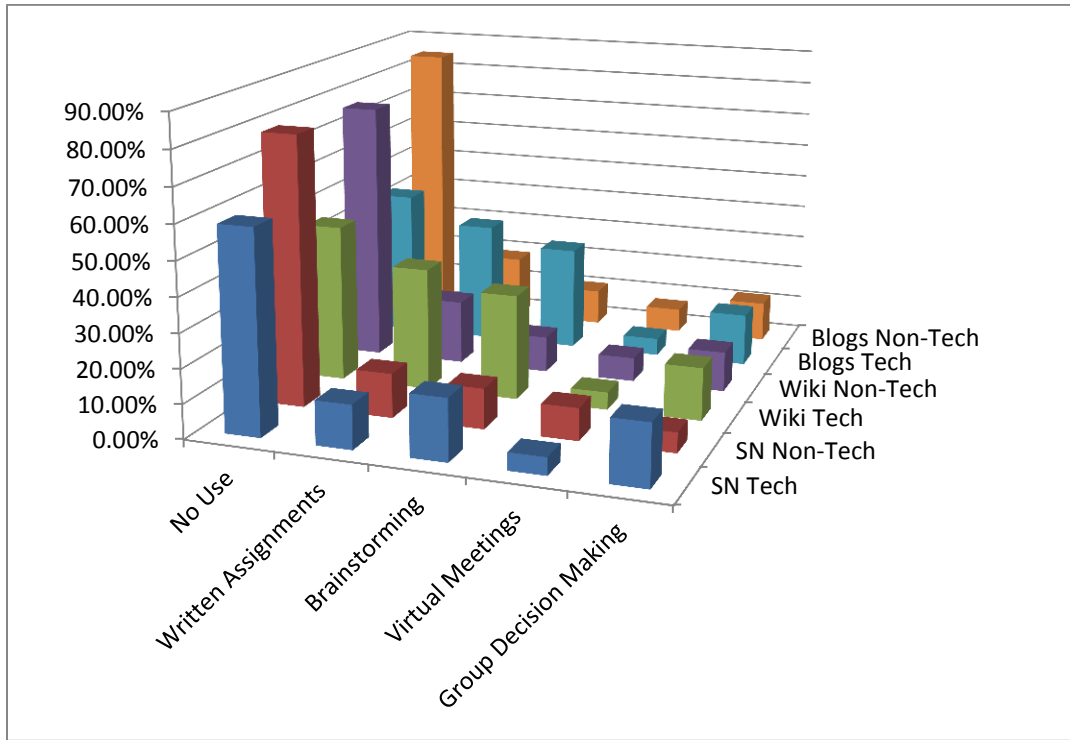
Have you used each of these technologies for instructional purposes? (Please select all that apply.) The use section of the questionnaire measured use in five different areas. These five areas include: written assignments, oral assignments, brainstorming, virtual meetings, and group decision-making. Since these three technologies do not support oral assignments, it is not included in the analysis. The percentages for each question are shown in Table 9 and Chart 1.

Table 9

		No Use	Written Assignments	Brainstorming	Virtual Meetings	Group Decision Making
SN	Tech	58.97%	12.82%	17.95%	5.13%	17.95%
	Non-Tech	78.82%	12.94%	11.76%	9.41%	5.88%
Wiki	Tech	46.15%	35.90%	30.77%	5.13%	15.38%
	Non-Tech	76.47%	18.82%	10.59%	7.06%	11.76%
Blogs	Tech	43.59%	35.90%	30.77%	5.13%	15.38%
	Non-Tech	84.71%	18.82%	10.59%	7.06%	11.76%

Table 9 shows the percentage of tech professors is lower for no use in all areas as expected and higher in all other areas except social networks, written assignments and in all three areas for virtual meetings . This is illustrated in Chart 1.

Chart 1



T-test cannot be conducted for each item. These responses were summed and a t-test run on the summed data in table 10.

Table 10

	t-test for Equality of Means		
	t	df	Sig. (2-tailed)
Sum of all	1.925	122	.057
Sum of Social Networks	.973	122	.333
Sum of Wiki	1.484	122	.140
Sun of Blogs	2.469	122	.015

Table 10 shows a significant difference when all use results are totaled and for blogs. This provides support for hypothesis 3, tech professors to use Web 2.0 technologies more than other professors.

Conclusions and Future Research

Support for all three hypotheses was found. Indeed, technology professors have a greater knowledge, a more positive attitude, and use Web 2.0 technologies more frequently than other professors. Most troubling, though, is in this early stage of development, not all tech professors are using Web 2.0 technologies. These technologies already have profoundly impacted the daily lives of professors and students alike and will have a profound impact on the future of teaching. One would hope that

professors who specialize in the adoption, classroom adaptation and use of technology would be far ahead of others at this point.

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Globalization--How Has it Changed Teaching Strategies?

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Abstract

With the current trends of globalization, it is no longer acceptable to discuss information technology (IT) and operations management (OM) in a vacuum. IT and OM used to exist in organizations in one structure, then expanded to maybe a local network but now the networks are out in cyberspace. With the shift to international issues, there are challenges because you not only need to cover the core material in a given course, but you also need to expand the framework to include the environment that businesses are currently working in. In this paper, we discuss how this shift has affected the way in which professors go about teaching their students. One major shift that has occurred at our University is that all students need to take a course with a global component. In the past, IT and OM courses were taken primarily by business and technology majors, but with this new shift, we have adjusted the introductory IT course so that it meets this new global requirement. The OM course is likely to follow the same course once we have seen the results in IT.

This has made us examine the skills that we can expect from our students from different majors and backgrounds. We have had to incorporate a lot of new hands-on technology such as web searches, twitter and social networking sites. This has also lead to the inclusion of an ethics component, which in IT, leads to security and privacy issues. We look at how we have made adjustments to the course to meet the needs of today's students.

Introduction

To prepare students for the new “global” world environment the introductory Information Technology course has had to change gears and also focus on global and international issues and concepts. This paper describes the basics of the new IT course.

New Global Information Technology Course Description

Introduces students to the role of information technology in today’s global business, political, and government environments, and in society in general. It examines the role of technology globally, particularly as it is used for cultural awareness, business development, political change, and social improvement. The negative aspects of technology (e.g., dumping of end-of-life hardware in developing countries) are also discussed. The course studies infrastructure (hardware and software, networks, the Internet), communications, software and website development, databases, and information security and privacy.

New Global Information Technology Course Objectives

Upon successful completion of this course, students will be expected to:

- a. Analyze information systems based on the idea that information is a critical resource to the organization that in turn influences the management of other resources;
- b. Document the concepts of information within the organization i.e. what questions should be asked to collect information, why and with what priority.
- c. Establish how information systems fit within an organization to support its processes and division of work;
- d. Explain the essentials of information systems and subsystems in terms of purposes, processes, boundaries, and value;
- e. Identify facts or ideas on the importance of advances in technology in the design and development of new information systems;
- f. Summarize the role of people in the operation of information systems.
- g. Plan how information systems can be developed to accomplish organizational objectives; and

- h. Discuss the ethical concerns associated with information systems including security and privacy.

New Global Course Broad Purpose of the Course

The broad purpose of the course is to explore the role of computers in this global age and understand how computers are used in business and in the global society. The basic tenet is that information is a critical resource and that using technology effectively to communicate and to disseminate information can influence many aspects of the life of citizens throughout the world. For example, students should become more aware of the importance of social media and the ethical implications of the use of technology.

Incorporation of a New Case Study Assignment

In order to meet the objectives of the new course, we have added a new case study assignment in which the students have to research a specific country and relate the information about that country to technology. A copy of the assignment outline is below.

Group Country Project Assignment

Working in groups of 3 to 5 team members, complete the following project:

You are an intern in the International Studies Office at Marymount University. You need to present your proposal for a study-trip to a country of your choice. One person in the group must have been communicating with one or more persons in the country during the semester. Your proposal must include facts, cultural information, photos, and video from the country you select. You can present your proposal as a multi-media PowerPoint presentation or make a video which you upload to the Marymount Channel on YouTube. Guest speaker will be invited to provide detailed instructions on how to do multi-media PowerPoint presentations or YouTube videos. The deliverables are a report and a presentation at the end of this semester.

Group Country Project Outline

Your group project is a multi-media presentation about the country you have selected. You need to prepare a 12-15 minute presentation that includes video, pictures, links and information from the given country. You need to create the video using the

editing software we discuss in class and viewed in the e-learning center in the library. The software is FinalCut and if you want to use a different package, you need to get permission from me. You also need to submit a report with your project that includes a more detailed analysis of each area. Your Powerpoint presentation should include a link to the youtube video that your group creates.

Suggested Outline:

- Introduction
- Background
- Politics
- Economics
- Military/Law Enforcement
- Medicine
- Education
- Communication
- Governmental Policy
- Environmental Standards and Policies
- Cuisine, Language and Culture
- Conclusions and Recommendations

Be Creative--

Given this is an IT class, you need to discuss each of these areas with respect to technology. Your discussion should include the history of each topic, current practices and future plans. Each member needs to present; if you do not present, you will receive a zero for the assignment. You will be expected to provide feedback about your own group members as well as your other classmate's presentations. This is part of your grade and you will be provided with feedback forms.

The project not only incorporates information about the given country, it also uses the latest technologies such as blogging, editing and creating multi-media powerpoint presentation, using social media to contact and communicate with people from the country and then upload the video to the web. The assignment incorporates key information that they need to be familiar with, as well as learning about other cultures and countries. One of the key objectives of the projects is to incorporate how technology is at different levels globally. It is designed to increase awareness and sensitivity towards other cultures and expand their knowledge about the differences.

Informational Resources and Links to Aid in the Project

Social Media for Business by John Jantsch (See PDF file)	pdf file on Blackboard
TwitterforBusiness.pdf	Pdf on Blackboard
Twitter for Business by John Jantsch, available as a PDF.	Pdf on Blackboard
"Robot Pals" by Alan Alda, host of <i>Scientific American Frontiers</i> .	www.pbs.org/saf/1510/video/watchonline.htm
Eric Schmidt, CEO of Google presentation at HIMSS Conference, February, 2008.	www.youtube.com/watch?v=dTZKNcx9sBA
"Google Earth, Nine Inch Nails, and Real-time Geo Community."	www.youtube.com/watch?v=ifmZSC8ca6Q
Cars That Think." by Alan Alda, host of <i>Scientific American Frontiers</i> .	www.pbs.org/saf/1502/video/watchonline.htm
"The Story of Stuff."	www.storyofstuff.com/
The Other Side of Outsourcing." By Tom Friedman, author of <i>The World is Flat</i> .	http://www.youtube.com/watch?v=jQaHrcwKsoc
The Systems Development Lifecycle	http://en.wikipedia.org/wiki/Systems_Development_Life_Cycle

Note: These were compiled by the faculty to assist the students with their projects, assignments and exams.

Conclusions

This past Fall was the first semester that the new global syllabus was implemented. We are currently evaluating the feedback from the students about their experiences in the course. We are hoping to receive positive responses and that the students found it useful not only to learn about their own countries, but about the other projects in the class.

Marymount University is trying to maintain a new, up-to-date curriculum for our IT students. In the past the course was offered at the Junior level, and has now been changed to a Freshman level. This was due to the demands of the world of technology that everyone is operating in today. It is critical for them to learn the skills earlier in their programs, so that they can incorporate the skills in all of their other courses.

Future research will include a Statistical analysis about the student feedback in the course evaluations to determine if the course is meeting their expectations and needs in the workplace. We are also working with our Advisory Board in IT to incorporate the latest trends in technology. Our goal is to prepare our students so that they are able to meet specific technology requirements of their employers and to be successful in their future careers.

References

All information was gathered from the syllabus of the new global technology course, Information Technology in the Global Age, IT110, Fall 2011. Marymount University.

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THE LOWEST COMMON DENOMINATOR FOR INNOVATION

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ABSTRACT

Innovation requires the ability to explore and synthesize diverse areas of expertise, to bridge cultural divides, and to familiarize contributors with contexts beyond the scope of their common experience. This paper describes decision making strategies that have proven invaluable in multi-disciplinary research conducted in the College of Design, Architecture, Art, and Planning at the University of Cincinnati and for external educational structures.

INTRODUCTION

As the problems presented in most fields have become increasingly complex, technological advances have simultaneously demanded the development of precise specialization. These parallel forces necessitate collaboration. Relevant to curricula and pedagogy, students must be equipped to facilitate and participate in vital interdisciplinary partnerships. The scenario framework provides a structured means of transferring knowledge among participants of different backgrounds, but requires commonality of understanding and shared comprehension. Scenario learning provides a means to harness creativity and fuse it with pragmatism to simultaneously generate informed and innovative design solutions.

Multi-disciplinary work at the university level offers a number of opportunities for innovative exploration. It also comes with an equal number of challenges that can render students and faculty helpless and bring a project to a screeching halt. With every discipline comes an entire dictionary of terms that have specific meaning for the individual field. Many breakdowns in communication can occur within a single sentence. The way successful groups get around these hurdles is by taking their base of knowledge and bringing it down to a level understood by all of the members of the collective group. This simplification of terms, practices and procedures allows for a communal acceptance and definition of roles and responsibilities. Managers of the project now understand the individual stakeholders' roles and can efficiently assign tasks. The team, having started from the same point, can grow their knowledge as a group by allowing the separate members to fill in content expertise when needed. This continues on until the project is completed, the research is done, or whatever the end result may be. If a paper or papers are to be written as an extension of

the project or as a model for publishing results then the group must return to that base knowledge and bring the reader up to speed.

This education of the audience is crucial if they are to understand the breadth of knowledge used in the process of working as a team. If team A writes a paper about their role in the project, they must first be able to define the project and then what they contributed and lastly their findings and outcomes. The same thing goes for team B. They too must have this core structure and they may even go into talking a bit about how they worked with team A and how their findings affected the outcome of the work they were doing. But what is to come of that core set of knowledge? Does it rest within the lines of text of papers to be published or on stark powerpoint slides or can it live on in another level of education? Because of the defined simplicity of vocabulary and the breaking down of information into elementary forms, this body of knowledge has a wide audience that can take in and accept this information. Why not take this to younger audiences in the primary and secondary educational structures?

Before a project can effectively begin, a few things must occur. The definition of key members and their roles must be established. Then a focus should be assigned. Last, a rough timeline for the project should be created to allow for initial constraint. In order to clearly define roles, the team has to understand what the individual members can do, and in order to do that, they are going to have to learn a little.

Progressing from the (scenario) research and analysis phase of the project, several guiding principles for concept development are established. These principles are synthesized from the gamut of considerations raised through scenario learning. Some address design from a functional perspective, while others address psychological or experiential characteristics. These principles help determine a list of key design features necessary to concept development. The concepts guide the evolution of ideas from the realm of research to that of a physical proposal. Now we have a plan.

BACKGROUND

The suitability of scenario learning for higher education has been widely documented (Hertel and Millis 2002). The fields of administration, business, engineering, management, public policy, public relations, law, and medicine have all been identified as relevant disciplines in which scenario learning has been used to facilitate the identification of solutions to complex multifaceted problems both within academia and practice (Ringland 2002; Toth 2007). Scenario learning has been employed to achieve a range of objectives: to engage students, to extract contributions from multiple disciplines, to forecast event outcomes, and to highlight potential problems.

Student response in design education typically relies upon knowledge gained through experience, observation, or direct participation. This is supplemented through research and the use of precedents to provide guidance regarding the translation of ideas and concepts to built form. Individual exploration through the development of sketches and models, experimentation to facilitate learning through trial and error and the development of physical mock-ups, and reviews

and critiques, are integrated into the hands-on environment of design education. These are the methods by which students receive internal and external feedback and learn to refine designs.

As emerging professionals, students face evolving complexities in present and future society. The relevance and applicability of personal experience may erode based on the nature of the problem, and must be supplemented with new understanding and information. In the context of innovation, applicable precedents may not exist. In some cases the demands of the contextual environment may have zero tolerance for error. The traditional knowledge base alone is no longer sufficient, especially in designing for extreme environments. Under these circumstances a new paradigm is needed for design education, one that is less reliant upon conventional iterative methods of skill and design development. Now we have a movement.

PROBLEM STATEMENT

The emerging trend of collaboration within university education demonstrates many of the accompanying and inherent challenges embodied by projects of this nature. Collaborative engagement both across the campus and around the world is an evolution of the University of Cincinnati's 100-year history of Co-operative education in partnering with industry to provide contemporary context for academic inquiry and application:

The University of Cincinnati is the global birthplace of cooperative education. In 1906, 27 engineering students here piloted an uncertain experiment alternating time spent at school with professional work experience. Now, 100 years and 43 countries later, generations of students worldwide have followed our lead.

When the previous century was young – in 1906 to be exact – [Dean Herman Schneider] built a tenuous bridge between education's ivory tower and industry's smokestack. He sent 27 untested engineering students into turn-of-the-century mines and mills to see what lessons they'd learn from the paid positions he'd arranged for them.

So, UC began what's known around the world – in 43 countries at last count – as "Cooperative Education," a timeless practice of transforming youth to experience.

Today as we approach the 2005-2006 school year, hundreds of thousands of students studying everything from accounting to urban affairs continue the ever-expanding educational experiment – which was once defined in Webster's unabridged dictionary as "The Cincinnati Plan." Using the classroom as their home base, students around the globe alternate days, quarters or semesters spent in school with paid, professional experience related directly to their majors, just like those first UC students.

M.B. Reilly

The Ivory Tower and the Smokestack: 100 Years of Cooperative Education at UC

Partnerships can span a range of divides: disconnects between academia and practice; culture and language differences; disciplinary divides; and faculty and student experiences. Building a unified

understanding from elemental shared understandings mitigates those hurdles. Recording those paths of knowledge in a visual and verbal document establishes a common reference throughout the research effort to brief each new contributor to the project as to the origin of decisions. By offering these visual and verbal cues, we are able to transcend communication barriers that may stall a project. The complement of visuals illustrating text and text supporting visuals clarifies the information (data) gathered to facilitate a lucid definition of the topic (problem). Now, we have a project.

FOCUS

Our project brings together architecture, engineering, geology, interior and product design experts all focused on supporting scientific exploration. Measures of design success are often much more subjective than the metrics of geology and engineering. The criteria of acceptable performance in terms of design are often personal or abstract (e.g. comfort), and elude evaluation by objective measures and thresholds. In terms of designing for new frontiers, effectiveness is measured in terms of the facilitation of human performance. Achievement of this goal requires not so much a new conception of space, but rather new capabilities for the management of complexity, performance innovation, and the accommodation of unforeseen future developments.

In our designing for extreme environments project, multiple simulations were documented, shared, and analyzed. Analyzing the simplified simulations identified critical factors. From the simulations, diverse scenarios were developed, vetted, and revised as a tool to understand the ramifications of these factors. transcribed in the team's common language. Discussing the scenarios with the diversity of stakeholders revealed multiple insights for the entire team. The discussion's effectiveness was enabled by the prior formation and acceptance of a common language. Now, we have a team.

SUMMARY

Scenarios can be used to facilitate the identification of solutions to complex multifaceted problems. They provide a means to grapple with uncertainty and unfamiliarity, while accommodating diversity and multidisciplinary collaboration. This paper posits that scenario learning offers a process to engage in “non-routine creative problem solving” (Mayer 1995), a process that “involves finding a solution to a problem that has not been solved previously” (Arp 2008). Scenarios also act as a framework for inquiry by prompting and eliciting input and feedback from participants. In its simplest form, scenario learning can consist of a basic “what if” question posed to stimulate thought and response. At the opposite end of the spectrum lies what some researchers have termed the “extended simulation” (Hertel and Millis 2002, 91). Multiple objectives and in-depth exploration of a variety of outcomes and possibilities can be accommodated through this type of approach. With increased complexity, the need for a common language is required for shared documentation of the investigative process.

In our case, we had an eager film crew who acknowledged the importance of sharing this information to the masses. What started as a highlight piece quickly grew into a year-long

documentary and yielded several stand alone teaching tools. These tools were focused for use at the university level for further advancement of teaching models. These tools then acquire an “on-boarding” role as new students are exposed to multi-disciplinary work and research foci outside of their knowledge base. Additionally these models can be interpreted for earlier education levels, providing younger students with exposure to non-traditional research methods and topics of international appeal. Our hope is to capture student/faculty interest and that of third parties with resources to support collaboration at this level.

Documented simulations and scenario learning offer many advantages in overcoming resource limits so defining to many experiential creative learning models. These are models that can be passed down to earlier stages of learning for use and familiarization to enhance and further the development of teaching research strategy. Now, we have a future.

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Integrate the Teachings of Statistics and Management Science Using Conjoint Product Design Problem

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Methods from both fields of statistics and management science have been jointly applied to solve many complex business problems. In recognition of such a trend, business schools have combined topics from both areas when offering quantitatively-oriented courses in hope of equipping students with an integrated perspective on quantitative analysis processes. However, due to the lack of teaching materials that bridge the conceptual gaps of these two fields, students oftentimes come out of the class without a real sense of integration of the fields of statistics and management science as complementary tools for solving problems. This paper demonstrates a conjoint product design process that establishes some natural links between several key concepts from the two areas - all tied up by using a real problem that is faced by many firms. The complete model can be readily implemented in Excel by using the Regression and Solver options. This teaching material has been well-received by the students who greatly appreciated the integrative nature of the problem solving approach.

INTRODUCTION

The importance of equipping students with an integrated perspective of a decision making process cannot be overly emphasized. Much research has been done on how to integrate the business curriculums (Hamilton et al., 2000). Although a complete integration across curriculums is a challenging task that involves different departments of conflicting interests (Closs and Stank, 1999), an integration of subjects within a discipline can be achieved by individual instructors and serves as a foundation for future integration across curriculums.

Methods from both fields of statistics and management science have been jointly applied to solve many complex business problems in current business transactions and practice (e.g., conjoint product design problem in marketing, portfolio selection problem in finance, and inventory management problem in operations management). In recognition of such a trend, many AACSB-accredited business schools offer an aggregated quantitatively-oriented course that covers topics from both areas (Albritton et al., 2003). However, due to the lack of teaching materials that bridge the key concepts from the two fields, students oftentimes come out of class without a clear understanding of how statistics and management science can be complementary tools for solving problems. This is unfortunate because there exist many opportunities to demonstrate how the two areas can strengthen each other when implemented together to solve real business problems. For example, Albritton and McMullen (2006) integrated the two areas by applying optimization technique to derive optimal parameters in a forecasting model.

Among many business processes that utilize statistics and management science techniques complementarily, conjoint analysis (CA) is one of the most popular marketing methods for estimating consumer preference and evaluating the potential of new products (Green et al., 2001). Sawtooth Software, an industry leader in CA, conducted at least 5,000 CA projects in 2003 (Huber, 2005). Components of CA have been sporadically introduced in several textbooks. For example, Anderson et al. (2008) applied an integer programming model to solve the conjoint product design problem with the objective of designing a pizza that will attract most customers. The case problem illustrated in what follows is a simplified version of a typical CA project that establishes some natural links between the

concepts of regression analysis and linear integer programming from statistics and management science, respectively. The complete model can be readily implemented in Excel by using the Regression and Solver options.

PROBLEM BACKGROUND

Savannah Chocolatier, a maker of gourmet chocolates, has several boutique confectionery shops in the historical area of downtown Savannah, GA. The management team is in the process of launching a new chocolate product and has defined 3 key attributes and a total of 8 levels of interest (see Table 1). Either a rankings/ratings task or a choice-based experiment can be used to elicit respondents' utilities for each attribute level (Kuhfeld, 2004). To better suit the target audiences of this teaching brief (upper level undergraduate and graduate business students), we will adopt a simple factorial design that only considers main effects. With each attribute having 2 to 3 levels, the design yields 18 chocolate profiles (see Table 2). The company has recruited a sample of 8 respondents who are representative of the Savannah visitors' market and asked each of them to rate the 18 profiles on a 10-point scale to indicate his/her preference (0 being the least preferred and 10 the most preferred). The main competition comes from a type of chocolate that has Milk, W/ Liquor, and No Nuts attribute levels. The problem posed here is to estimate each respondent's utility for each attribute level and then design a new chocolate product so that a maximum number of respondents will choose the resulting new product over the competition (i.e., maximize the market share of the new product in lieu of the competition).

Table 1: Chocolate Attributes and Levels

Attributes	Levels		
Color	(1) White	(2) Milk	(3) Dark
Filling	(4) W/ Liquor	(5) W/O Liquor	
Nuts	(6) No Nuts	(7) Almonds	(8) Macadamia

Table 2: Ratings of 18 Chocolate Products by 8 Respondents

	Chocolate Description			Respondent Ratings							
	Color	Filling	Nuts	1	2	3	4	5	6	7	8
1	White	W/ Liquor	No Nuts	5	4	4	4	4	5	6	3
2	White	W/ Liquor	Almonds	5	4	4	4	4	5	6	3
3	White	W/ Liquor	Macadamia	10	0	8	9	8	1	2	0
4	White	W/O Liquor	No Nuts	2	7	2	1	1	7	10	4
5	White	W/O Liquor	Almonds	5	4	4	4	4	5	6	3
6	White	W/O Liquor	Macadamia	8	2	6	7	7	2	2	1
7	Milk	W/ Liquor	No Nuts	3	6	2	2	2	6	8	4
8	Milk	W/ Liquor	Almonds	5	4	4	4	4	5	6	3
9	Milk	W/ Liquor	Macadamia	7	3	5	6	6	3	4	2
10	Milk	W/O Liquor	No Nuts	1	8	1	0	1	8	10	5
11	Milk	W/O Liquor	Almonds	4	5	3	3	3	5	7	3
12	Milk	W/O Liquor	Macadamia	5	4	4	4	4	5	6	3
13	Dark	W/ Liquor	No Nuts	0	8	0	0	0	9	10	5
14	Dark	W/ Liquor	Almonds	3	6	2	2	2	6	8	4
15	Dark	W/ Liquor	Macadamia	5	4	4	4	4	5	6	3
16	Dark	W/O Liquor	No Nuts	1	8	1	0	1	8	10	5
17	Dark	W/O Liquor	Almonds	3	6	2	2	2	6	8	4
18	Dark	W/O Liquor	Macadamia	4	5	3	3	3	5	7	3

PHASE I OF CONJOINT ANALYSIS – ESTIMATION

We first dummy coded the attribute levels for each of the 18 products by treating the first level of each attribute (levels 1, 4, and 6) as the reference category and an output of OLS regression analysis for the 1st respondent is shown in Table 3 (by using the Analysis Toolpak in Excel). The Coefficients column of the output estimates the utility that the 1st respondent has for each attribute level - partworth utilities. The correct way of interpreting the coefficients of the dummy variables needs to be conveyed to students in great detail. Students should understand that the values of the coefficients are relative to the reference category.

Partworth utilities can be used to predict the total utility a respondent has for any combinations of the attribute levels by adding up the corresponding partworth utilities. For example, the total utility the 1st respondent has for the competitive product (Milk, W/ Liquor, and No Nuts) is 2.5. Similar regression analysis can be performed for the remaining 7 respondents by replacing ratings of the 1st respondent in Table 3 with the respective respondent. A summary of the partworth utilities for all 8 respondents and

their total utilities for the competitive product is given in Table 4. We assume a linear deterministic utility rule according to which that a respondent will choose a product that offers the highest utility. We have computed the total utility each respondent has for the competitive product. The next step is to choose a level from each attribute so that the total utility offered by the new design exceeds a maximum number of respondents' utility for the competitive product.

Table 3: Utility Estimation by OLS Regression Analysis for the 1st Respondent

Profile	Color		Filling	Nuts		1st Respondent
	Milk	Dark	W/O Liquor	Almonds	Macadamia	Rating
1	0	0	0	0	0	5
2	0	0	0	1	0	5
3	0	0	0	0	1	10
4	0	0	1	0	0	2
5	0	0	1	1	0	5
6	0	0	1	0	1	8
7	1	0	0	0	0	3
8	1	0	0	1	0	5
9	1	0	0	0	1	7
10	1	0	1	0	0	1
11	1	0	1	1	0	4
12	1	0	1	0	1	5
13	0	1	0	0	0	0
14	0	1	0	1	0	3
15	0	1	0	0	1	5
16	0	1	1	0	0	1
17	0	1	1	1	0	3
18	0	1	1	0	1	4

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4.166666667	0.544331054	7.6546554	5.89E-06	2.9806712	5.352662149	2.980671184	5.352662149
Milk	-1.666666667	0.544331054	-3.061862	0.0098648	-2.852662	-0.480671184	-2.852662149	-0.48067118
Dark	-3.166666667	0.544331054	-5.817538	8.244E-05	-4.352662	-1.980671184	-4.352662149	-1.98067118
W/O Liquor	-1.111111111	0.444444444	-2.5	0.0279154	-2.079472	-0.142749855	-2.079472368	-0.14274985
Almonds	2.166666667	0.544331054	3.9804208	0.0018249	0.9806712	3.352662149	0.980671184	3.352662149
Macadamia	4.5	0.544331054	8.2670279	2.682E-06	3.3140045	5.685995483	3.314004517	5.685995483

Table 4: Partworth Utilities and Total Utilities for the Competitive Product (All Respondents)

Respondent	Color			Filling		Nuts			Regression Model	Utility
	White	Milk	Dark	W/ Liquor	W/O Liquor	No Nuts	Almonds	Macadamia	Intercept	Competitive Product
1	0.00	-1.67	-3.17	0.00	-1.11	0.00	2.17	4.50	4.17	2.50
2	0.00	1.50	2.67	0.00	1.11	0.00	-2.00	-3.83	4.89	6.39
3	0.00	-1.50	-2.67	0.00	-0.78	0.00	1.50	3.33	3.44	1.94
4	0.00	-1.67	-3.00	0.00	-1.22	0.00	2.00	4.33	3.33	1.67
5	0.00	-1.33	-2.67	0.00	-0.89	0.00	1.67	3.83	3.28	1.94
6	0.00	1.17	2.33	0.00	0.67	0.00	-1.83	-3.67	5.67	6.83
7	0.00	1.50	2.83	0.00	1.11	0.00	-2.17	-4.50	7.00	8.50
8	0.00	1.00	1.67	0.00	0.44	0.00	-1.00	-2.33	3.22	4.22
Competition	0	1	0	1	0	1	0	0		

PHASE II OF CONJOINT ANALYSIS - OPTIMIZATION

We define sets I , A , and L to represent respondents, attributes, and levels. We use parameter u_{il} to represent the partworth utility of level $l \in L$ for respondent $i \in I$ (e.g., $u_{12} = -1.67$). The utility a respondent has for the competitive product is h_i (e.g., $h_1 = 2.5$). The regression model intercept for respondent i is $Intercept_i$. We define two binary decision variables:

$X_l = 1$ if level $l \in L$ is included in the new chocolate product and 0 otherwise.

$Y_i = 1$ if the total utility offered by the new chocolate product exceeds the utility offered by the competitive product for respondent $i \in I$. The binary integer program model is defined as follows.

Objective Function:
$$\text{Max } \sum_{i \in I} Y_i$$

Constraints:
$$\sum_{l \in L} u_{il} X_l + Intercept_i \geq h_i Y_i + 1 \quad \forall i \in I \quad (1)$$

$$\sum_{l \in L_a} X_l = 1 \quad \forall a \in A \quad (2)$$

X_l and Y_i Binary

Constraint set (1) ensures the utility offered by the new chocolate exceed the utility of the competitive product by at least one unit following the benchmark used in Anderson et al. (2008, page

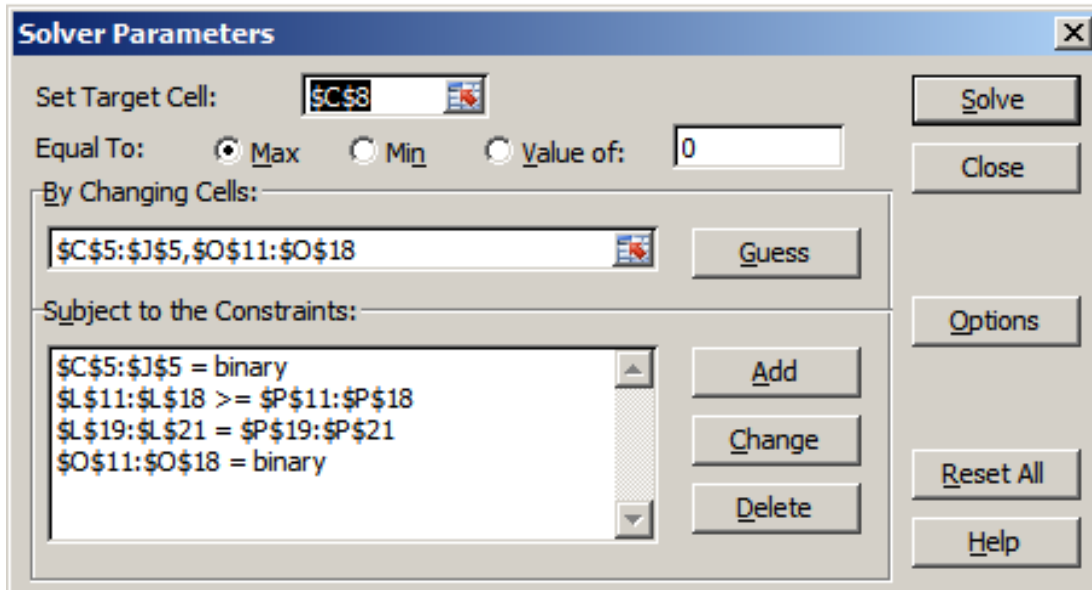
338). Constraint set (2) makes sure that the product is feasible by only selecting a single level from each attribute. The objective function counts the total number of respondents who will choose the newly designed chocolate product. If students have trouble understanding the algebraic model, a long version of the model can be used instead. Students should be able to figure out the number of decision variables and constraints in the model prior to setting it up in Excel.

Numerous studies have been conducted to investigate issues in implementing integer program models in Excel (Pachamanova, 2006; Grossman, 2006; Brown and Dell, 2007). The complete model and solver window are shown in Tables 5 and 6, respectively. A couple of issues are worth further discussions here. First, when binary variables are present in the model, students have a habit of modeling them using IF statement. Although logically correct, IF statement changes the model from a linear form into a non-linear one which can cause complications when the model is later solved by Excel Solver. Second, this problem has alternate optimal solutions. Different sets of optimal decision variables can result in the same optimal market coverage. The optimal chocolate profile shown in Table 5 has Milk, W/Liquor, and Almonds attribute levels. The objective function indicates 4 out of a total of 8 respondents will choose the new product over the competitive product which translates into a market share of 50%. Last, the readability of Solver Answer Report (not shown here) need to be addressed (Evans, 2008). The location of the label names in Table 5 will determine how Target Cells, Changing Cells, and Constraints are labeled in the Answer Report.

Table 5: Binary Integer Model Setup in Excel

1A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
2	Decision Variables															
3	Attribute	Color			Filling			Nuts								
4	Levels	White	Milk	Dark	W/ Liquor	W/O Liquor	No Nuts	Almonds	Macadamia							
5	X Variables	0	1	0	1	0	0	1	0							
6																
7	Objective Function															
8	Market Coverage	4														
9																
10	Constraints											Intercept	LHS	Utility Competitor	Y Variables	RHS
11	Respondent 1	0.00	-1.67	-3.17	0.00	-1.11	0.00	2.17	4.50	4.17	4.67	>=	2.50	1	3.50	
12	Respondent 2	0.00	1.50	2.67	0.00	1.11	0.00	-2.00	-3.83	4.89	4.39	>=	6.39	0	1.00	
13	Respondent 3	0.00	-1.50	-2.67	0.00	-0.78	0.00	1.50	3.33	3.44	3.44	>=	1.94	1	2.94	
14	Respondent 4	0.00	-1.67	-3.00	0.00	-1.22	0.00	2.00	4.33	3.33	3.67	>=	1.67	1	2.67	
15	Respondent 5	0.00	-1.33	-2.67	0.00	-0.89	0.00	1.67	3.83	3.28	3.61	>=	1.94	1	2.94	
16	Respondent 6	0.00	1.17	2.33	0.00	0.67	0.00	-1.83	-3.67	5.67	5.00	>=	6.83	0	1.00	
17	Respondent 7	0.00	1.50	2.83	0.00	1.11	0.00	-2.17	-4.50	7.00	6.33	>=	8.50	0	1.00	
18	Respondent 8	0.00	1.00	1.67	0.00	0.44	0.00	-1.00	-2.33	3.22	3.22	>=	4.22	0	1.00	
19	Color	1	1	1							1	=			1	
20	Filling				1	1					1	=			1	
21	Nuts						1	1	1		1	=			1	

Table 6: Excel Solver Window



CONCLUSIONS

This paper introduces an innovative method to integrate the teachings of statistics and management science. CA has been widely applied to design new products for the past 30-plus years and remains as a favorite method for marketing managers. The first step of the analysis is to use regression with dummy variables to estimate each respondent's utility for each attribute level. The second step involves a binary integer program to choose an optimal level from each attribute in such a way that the new product will attract most customers in the market. This teaching material has been used in both upper undergraduate and graduate levels quantitative classes for business students. The problem was presented to students as a class example towards the end of semester. Supplementary readings were usually provided to the students prior to the lecture (e.g., Curry, 1996; Orme, 2010). In my classroom experience, students greatly appreciated the integrative nature of the problem solving approach.

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ANALYSIS AFTER OUTPUT – OVERVIEW

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ABSTRACT

There is very little argument given when anyone states that business people (particularly business students) need to be able to analyze data. Management Science, as a class in the business curriculum, is an excellent place to teach this process, based on the tools traditionally taught. This paper outlines a process whereby students are taught the skills of analysis through the medium of a set of management science and basic decision making tools.

INTRODUCTION

One outline of the decision making process might be:

- 1) Define the problem
- 2) Gather data
- 3) Create a model
- 4) Generate a solution
- 5) Implement
- 6) Monitor and adjust as needed

In theory, the entire process is taught in the course of the full business school curriculum. In practice, much of the curriculum focuses on steps one through four, ending when the students have used whatever model is being taught and have a solution in hand. The implicit assumption in this approach is that the models are capable of generating a solution that can (and should) be implemented. This relieves the decision maker of any further need to understand the problem or consider options – the solution (often, again implicitly, the best solution) has been found. No further work is needed.

The problem with this is that most models are too simple to adequately capture the complexity of the business world. Certainly there are more complex models that do a better job, but those models require their own brand of expertise to use effectively, and most decision makers, while experts in their own fields, do not have that particular specialization. Thus, the models that decision makers are taught to use are insufficient to allow the decision makers to make good decisions. None-the-less, a decision maker is evaluated on the quality of his/her decisions.

By way of a definition, this paper considers a decision to be good if the decision maker correctly uses all available, relevant information. This says nothing about whether the decision is right or wrong - that will only be learned in the passage of time and may depend on events beyond the control of the decision maker. Making right decisions cannot be taught, but making good decisions can be. That is the process of analysis, and it becomes a new step in the decision making process outlined above. Following Step 4 – Generate a solution, the decision maker must consider the weaknesses of the model being used, study the output of the model to learn all s/he can, perhaps rerun the model with different data, and ultimately make a recommendation, potentially the same as the model's result, but not

necessarily. The benefit of analysis is that rather than simply accepting the result of the model, the decision maker knows why the recommendation has been made.

OVERVIEW

Given the number of management science tools that are available, a one-semester course must, necessarily, pick only a few to present to the students. The ones this paper will focus on are payoff tables, decision trees, the transportation algorithm, the linear programming algorithm, and simulation. This is not an ideal set of tools, and terminology could be debated for a long time, but the reasons for these choices will be explained below. I should note, however, that the primary reason for choosing these tools is that they are the ones that were taught in this class at my school when I started teaching here.

The order in which the tools are listed is non-traditional. Most textbooks begin with the optimization algorithms and place simple tools like tables and trees much later, usually under the heading of “Decision Making under Certainty” and “Decision Making under Uncertainty.” That makes perfect sense, I might note, when the focus is to teach the mathematics of the tools. Linear Programming is, mathematically, usually the most complex tool taught in business school management science courses, so placing it first gives the teacher extra time to cover it should problems arise. Changing the focus to teaching analysis requires that the tools be introduced in a different order, so the student is led from a simple level of analysis to a more demanding level.

The basic approach of the class is nothing new – case-based teaching. A series of five cases are presented to the class to be analyzed, each case based on a particular management science model. The students work in groups (typically starting at four or five students per group). The cases have all the data (and some extra) that is needed for the particular model being covered, although the students may have to manipulate the data with simple calculations before inputting it to the model.

There is one consistent lesson in the process of analysis – there are tradeoffs to everything. The tradeoff to teaching analysis is that time previously spent teaching the mathematics of the Management Science models has to be reduced. The approach begin outlined in this paper was developed while teaching undergraduates, but it has been fully implemented only in a graduate-level class. This is important because the students have been required to learn the basic mathematics of the models on their own. Some class time is devoted to answering questions to help the students more fully master the models, but lecture notes and examples are available to the students on a web site and the students are expected to have prepared themselves. While it might not be unreasonable to have the same expectations of undergraduate students, I suspect the results would not be as good. If there is any consolation to this tradeoff, it is that there is little indication that the students were absorbing the calculations of the models when they were being taught in detail, so the net loss might not be too bad.

One aspect that is invariant for the cases that are used is that multiple criteria have to be considered. Typically, the data of the case deals with only one of the criteria, making the MS model one-dimensional, so the students are forced to use the model as a starting point to reach the final answer.

COURSE OUTLINE

When students start with mathematics, they learn facts: $2 + 2 = 4$. That goes on for a long time, in the course of which some rules for manipulating the facts are introduced. Initially, there is no difference between facts and rules ($2 * 3 = 6$), but the rules can be applied to situations where memorization is not worthwhile – why would anyone memorize what $127 * 63$ is? The next step is to provide information about a desired value (called a variable), and calculations are needed to determine the final value. Again, this starts with simple things ($X + 2 = 4$) and progresses to more complex ones. The common factor in all of these is that there is always a single, correct answer – and one simple way (one criterion) to determine that answer.

Unfortunately (from the standpoint of our students), decision making in the business world is somewhat more complex. The course design is based on the following assumptions about decision making in the business world:

- (1) in the business world, all problems deal with multiple criteria (MC).
- (2) multi-criteria decision making (MCDM) models fall into the group of models that require an expert to use effectively.
- (3) if an analyst thoroughly understood a problem situation, then s/he could consider the MC aspects of the problem without resorting to MCDM techniques.
- (4) an analyst can use simple MS tools to increase their understanding of a problem situation.

Based on these assumptions, we must teach our students how to analyze data so they can effectively perform their jobs (make decisions). To begin to teach analysis, start with the most basic situation: a single decision must be made.

That statement, “a single decision must be made,” implies a couple of things: first, that there exists more than one alternative (else there is no decision) and two, that the future is uncertain (if that is not true, then it is not a decision, merely a calculation). This is the setting for a payoff table.

The purpose of this paper is NOT to describe (one more time) how to set up a payoff table or how to calculate the decision rules associated with it. The purpose is to point out that the name “decision rules” is a problem. The textbooks seem to imply that to make a decision all you have to do is select the appropriate rule. If you are optimistic, use MaxiMax, if you are pessimistic, use MaxiMin. If you are not sure, use an average (Equally Likely) or if you can estimate probabilities for the various possible futures, use a weighted average (Expected Value). The problem with each of these rules is that it takes a single view of the problem. Using a rule like this will make a decision, but the decision maker really doesn't know whether it was a good decision. This isn't all that much different from flipping a coin or throwing a dart to make a decision. Individually, the rules do not help the decision maker understand the problem situation.

Unless an alternative is overwhelmingly bad (in technical terms, dominated), then every alternative has something good about it and something bad about it. The decision maker must understand the strengths and weaknesses, risks and rewards, of each alternative. These risks and rewards can only be identified from considering the actual data, which for a payoff table would be the payoffs (whether profits or costs) and probabilities of each payoff occurring (if such information is available). Further, in a multi-criteria setting, a single aspect of an alternative can be both a risk and a reward, depending

on which criterion the decision maker is considering.

Each rule, by itself, considers only one aspect of the situation, but the rules taken together can create a fuller understanding. Some examples are:

- a) MaxiMax and MaxiMin, together, define the range of values for a decision alternative.
- b) The midpoint of that range, combined with the Equally Likely rule, tells whether the payoffs for the alternative cluster to the high or low end of the data range.
- c) The Expected Value, combined with the Equally Likely, indicates whether the higher payoffs have higher or lower weights (if $EV > EL$, then the higher payoffs have higher weights).

These simple comparisons (and more, if other rules are used), create only a basic understanding of the alternative. To understand fully, the decision maker must look at the payoffs themselves, not relying on the intermediate rules, and see how the basic understanding changes as the payoffs (and probabilities) themselves are considered. In this manner, the decision rules are no longer used to make decisions; instead, the rules provide the preliminary understanding about the situation that the decision maker needs before delving into the specifics of the data. Thus, a process is developed: first set up the payoff table, then calculate the rules, and use the rules and the data to understand the alternative before trying to compare the alternatives to make a decision.

The focus initially is entirely on a single alternative. For each alternative, look at the rules in combinations to begin to understand what the data is saying, then look at the data in detail, identifying whether a particular result represents a risk or a reward for that alternative. The data is considered first as individual values, and then in pairs or larger groups (working from the simple to the more complex). Only after the first alternative has been thoroughly understood should the analyst repeat the entire procedure for the second, third, and following alternatives, each considered in isolation.

Once all the alternatives have been considered individually, the process switches to looking at the alternatives in pairs, determine the relative risks and rewards of the alternatives, and trading off the various criteria to determine which alternative (of that pair) is preferred and why. A detailed example of this process for considering all the rules and then the true data of each alternative to create a list of risks and rewards for that alternative is described in [1].

Considering the alternatives individually allows for the identification of the risks and rewards associated with that alternative (remembering that additional risks and rewards are created by the various criteria that are part of the problem). Considering the alternatives in pairs identifies the relative risks and rewards of the alternatives. At the end of the comparisons, the decision maker will know two things – which of the alternatives to recommend, and why s/he considers that alternative to be superior to the others. As noted above, this is the goal of analysis, but rather than simply telling the students that this is necessary, a process has been given to them that they can apply to many decision situations, if the data is available (which will be addressed later in this paper).

The next step is to put the students into a more complex decision situation. Instead of facing a single decision, they must deal with multiple decisions, where the first decision affects the second, and maybe a third. This is the setting of a decision tree. Again, this paper will not present any of the details of setting up a decision tree. As above, a process will be presented, similar to the payoff table

in that it moves from a narrow focus to a wider one, but with a different model, the process changes.

Rather than going into a detailed analysis of the individual alternatives as suggested for the payoff table, the analysis moves directly to a comparison of alternatives (for one decision node) based on a single future. The idea is to be able to say which alternative would be chosen if that specific future were known to be occurring. Comparing the payoffs and probability of that payoff occurring allows the decision maker to decide his/her preferred tradeoffs for that limited view of the overall situation. Of course, it is not known which future will occur. Comparing the alternatives for the same decision node but for the next future, and the next, leaves the decision maker knowing which alternative s/he would choose (and why) for each future. Please note that this does not rely on expected values, the common rule for decision making with decision trees. The understanding of the relative risks and rewards of each alternative for all the futures, and a final comparison across all the futures leaves the decision maker knowing what the recommendation would be for that decision node, which is only a small part of the whole tree.

The analyst begins this node-by-node analysis on the right-hand side of the decision tree, so it begins with the decisions that come last in the sequential process that the tree represents. Each decision node on the right-hand side must be evaluated separately, using the simple process outlined above. The decisions made for these last nodes are used to make decisions in the earlier nodes, working backwards through the tree, right-to-left, until the original decision node is reached and analyzed.

The complexity of a decision tree comes from the many branches that show all the possibilities that the decision maker faces. By starting on the right hand side, the analyst can ignore most of the complexity, reducing it to a series of “if” statements – IF Alternative 1 was chosen and IF State-of-Nature 1 occurs, then the decision that must be made is ... (this would be for a tree with only two layers of decision nodes, but the process works for larger trees). Focusing on one decision node reduces the complexity to a manageable level. Working backwards through the tree also helps to reduce the complexity. When an earlier decision node (to the left) is analyzed (whether a mid-level node or the original decision), all subsequent decisions have already been made. This prunes the tree, cutting out one or more layers of decision nodes.

Cutting out the decision nodes that have been analyzed (since the decision has been made, the node is no longer shown), leaves the tree with state-of-nature nodes following state-of-nature nodes. This assumes that the decision nodes and state-of-nature nodes were alternating, but the process works even if that is not true. So, for the decision nodes to the middle or left of the tree, the analysis process changes a little. When a set of decision alternatives is compared for one state-of-nature, rather than finding payoffs at the ends of the branches, the analyst finds another state-of-nature node. The solution is simply to continue the process, picking one of the second set of states-of-nature and comparing the alternatives for that new level. This recursive process can go as deeply as it needs to, but the result is the same. One alternative is chosen for one state-of-nature. One alternative is chosen for the other states-of-nature emanating from that state-of-nature node. The various decisions that were chosen are reconciled (if necessary) for all the states-of-nature, so the analyst ends up with a single recommendation no matter which state-of-nature occurs. This, in turn, is used to move back to the previous state-of-nature node, where the process repeats, with reconciliation, so the analyst gains a single recommendation based, not on averages or expected values (which don't exist and will never happen), but on an understanding of the payoffs and probabilities associated with the decision node and subsequent nodes.

The process sounds confusing, but the full process, with examples, is covered in a separate paper published as a proceedings in [2], that is under revision before submission to a journal. That paper will be similar to [1], which explains the payoff table analysis process in detail.

While topics such as game theory and multi-criteria decision making are excellent background reading for payoff tables and decision trees, it is not necessary to spend time on the more complex techniques to calculate solutions using these models. Breaking down the simpler tools and concentrating on creating a thorough understanding of the data lets the decision maker handle the more complex concepts on their own.

The course now moves from simple decision making to using management science models to explore a decision situation. Specifically, two models are used: the transportation algorithm and the linear programming algorithm. Despite the many (nearly complete) similarities between the two models, they are covered separately not only to drive home the important lessons of using these algorithms, but because teaching the transportation algorithm first gives students a model they can readily grasp.

In many management science courses, linear programming could easily take up a third to a half of the semester. To gain even a low level of understanding of this data-rich model simply requires time. A rudimentary understanding of the calculations within the model is needed to grasp concepts such as sensitivity analysis and reduced costs. While all of this is explained in the material provided to the students, they really don't grasp it. They can grasp, however, the same concepts in the setting of the transportation algorithm. Using a transportation table, they can see that some routes are in use, and others aren't. They can see that using an empty route affects numerous other routes, and that making a series of changes to the routes creates a net change in cost. So, a minimal amount of time spent on the transportation table allows the students to grasp, by analogy if not calculation, the same concepts in the linear programming model.

Beyond creating some understanding of the mathematics, the output of the transportation algorithm is easy to grasp. Placing the solution in a transportation table lets the students see the solution, grasping it as a whole rather than a series of decision variables. Alterations to the data are simple to implement and the resultant changes to the solution are readily apparent. Sensitivity analysis, to a certain extent, is not important due to the robust nature of the transportation solutions. A series of lessons be brought out by making minor changes to the model, such as:

- 1) The model's requirements are strict, but if your situation is not a perfect fit, you can still usually manage to create an adequate fit
- 2) Computer printouts, even from algorithms, do not tell you everything you need to know, but the information is usually there if you look for it
- 3) Never trust a computer – an "optimal" solution can still be infeasible, especially in a multi-criteria setting
- 4) Once you go to the trouble of setting up a model, use it. Make minor changes to the data (always have a reason) and see how the solution changes.
- 5) Once you really know the model, you can answer some questions without resorting to rerunning the model.

One of the most important concepts is the limited nature of an optimal solution. Students think

“optimal” means “best,” which it does, but it only means “best for the data provided,” including the objective. Change the data, and you get another, equally optimal solution. The various optimal solutions score differently on the various criteria, leading right back to the necessity of comparing and trading off the solutions (many students, at this point, revert to using a form of a payoff table to keep track of their solutions).

The linear programming algorithm is the second algorithm the students work with. The lessons are the same as the students learned from the transportation algorithm, but the applications are much trickier and the output much more detailed. By this point in the semester, the students have learned to ask questions, and the classroom discussions are directed to lead the students to learn how much information is available to them, if they learn how to read the output and if they will, again, make changes to the data and rerun the model.

The final topic is simulation. Simulation is, by itself, a semester-long topic (or more), so not much can be done in a mere two weeks. The lessons from this most flexible of tools are:

- 1) While anything can be modeled, we still can't capture the complexity of the business world
- 2) Any output can be captured, but the user has to be smart enough to ask for it.
- 3) Simulation outputs are not optimal and simulation has no optimizing features

The simulation model is basically given to the students (there are minor steps needed to make it functional), but they have to select and program the outputs they want to see. Class time is devoted to me asking the students questions and the students realizing they need more (and different) outputs to answer the questions. In many ways, the simulation case is a “capstone” exercise, where the students pull together all the things they have (hopefully) learned during the semester of studying decision making and computer algorithms and apply to a free-form problem. The results can be surprisingly good.

The two algorithms and simulation models provide little new material in terms of teaching the students how to analyze data. The purpose of those cases is to provide emphasis on the gathering of information to feed into an analysis similar to (though not identical with) the work done in the first two topics. The one lesson that needs to be unlearned by the students is that the algorithms and simulation models do not automatically supply the best solution. This is particularly true with simulation, where there is no optimization at all, something that is obvious, perhaps, to the teachers, but not to the students.

Rather than viewing the algorithms and simulation as means of providing a solution, the students learn to use them as a means of providing the data that must then, in turn, be analyzed. Certainly the models can help the analyst gain insights into the problem situation, which in turn makes the analysis of the alternatives that have been generated that much easier, but the students learn that they are always, ultimately, responsible for understanding the data, however generated, and understanding why the alternative they choose is the best one for them.

CONCLUSION

Over more than twenty years of teaching management science, the class has moved from a straight-forward presentation of the various tools and how to read the outputs to a requiring the

students to apply the tools to problems and analyze (not just read) the results. Whatever tool is used, merely performing the calculations is not enough. From the simple tools, tables and trees, where the students learn to study the output to learn all they can about an alternative that has been given to them, to the algorithms and simulation, where the students have to make the choices that will create the data that is subsequently analyzed, the class forces the students to reach a stage where they not only can give a recommendation, but can defend that recommendation because they know what trade-offs they made to reach it.

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USING VIRTUALIZATION AS A TEACHING TOOL IN A COMPUTER LAB SETTING: EXPLORING OPPORTUNITIES AND ISSUES

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ABSTRACT

This workshop seeks to explore the various ways virtualization can be employed in a computer lab within a higher education environment. Participants will discuss the ways that virtual machine technology can be utilized to add benefits to the instructional process while often simplifying lab management. The technology can also preclude down time or disruptions. Hands-on demonstrations will be employed and interactive participation will be encouraged. The implementation of this approach has been proven to provide a high degree of flexibility in a computer lab at a very reasonable cost. In addition, all of the resources are easy to update and simple to re-use in the subsequent semesters.

BACKGROUND

The Implementation and use of virtual machine technology has evolved since its advent as a means by which an operating system could cope with various compatibility and interchangeability issues. Those tools have morphed into a whole new domain in computing technology. By employing virtual machine technology (virtualization) one is able to have a single “host” computer serve as a platform for several different concurrent “guest” operating systems. This capability has been found to provide many advantages in a business setting, especially for those who are operating large data centers. In a similar manner, this technology can provide a vehicle that helps overcome or avoid several issues when trying to teach multiple courses in a single typical general purpose computer lab in a higher education setting.

Specific Issues for Discussion:

1. The workshop will explore and demonstrate the features of an installation using VMware.
2. We will encourage exploration of an actual installation on the Coordinator’s system or on a participant’s system.
3. The cost of implementation for several of the systems including hardware requirements and supporting data drives will be explored.
4. Discussions will also revolve around the benefits for a computer lab or classroom teaching environment.
5. The workshop will also consider administrative issues and technical concerns as possible drawbacks to this approach.

IMPLEMENTATION

The first component needed to implement virtualization is to purchase and load the appropriate software on the host machine. There are several packages available, and each has advantages and disadvantages. Most are also limited to specific platforms. The following is a tentative listing of virtualization software currently available:

- VMware – the industry leader; about \$190 per workstation. (Lo, 2007) (VMware, 2010) Windows, Linux, Mac.
- Microsoft Hyper-V, Virtual Machine Manager, and Windows Virtual PC – Windows and certain Linux distributions. (Microsoft, 2010a & b)
- Parallels Desktop 4 for Windows & Linux; about \$80 (parallels.com, 2010) Also a Mac version
- Citrix XenServer – Windows and Linux. Formerly free open source but now has fee-based corporate support. (Citrix, 2010)
- QEMU – Open source Windows and Linux (QEMU.org, 2010)

Once the virtualization software is running you simply create new virtual machines from the operating system source disks or image files. Once they are installed, you can run the host operating system as well as all of the added guest machines at the same time and move easily from one to the other. They have access to most of the resources of the host machine including network connections and the CD-ROM drive.

Costs and Procedures

The expected cost to go from a traditional lab to the inclusion of virtualization technology can be considerably less than other methods of arriving at the same capability. A virtual machine installation will sit on top of the standard operating system. This is generally a much better approach than removable hard-drives or reloading a complete image file for the different installation requirements. The approach offered by our tech support folks was to use VMware workstation running on an XP Pro operating system. The software lists for about \$190 per license, and we used a small 2.5 inch portable hard drive for the student files at a cost of about \$50 each. These drives are very durable and are easy to erase and re-use. We elected to assign a drive to each student and to keep them locked in a cabinet in the computer lab so that each person's work is essentially protected. The cost for an installation such as ours would be about \$7500 for a 26 station Windows lab accommodating 50 students in 2 sections along with one workstation for the instructor.

Another use of virtualization technology involves the use of a small virtualization device that provides a monitor, a keyboard, and a mouse for each workstation. This approach relies on a central host to provide computing power. (Eng, 2007) This is similar to the old mainframe model with dumb terminals. While this can be an economical arrangement from an initial cost standpoint, the failure of the central server will shut down the entire lab. (Butler, 2009) (Anisetti, et.al. 2007) In addition, this approach does not address the issue of separation and control of the student files in the same manner as removable drives. This approach has been found to work well for a library or an open general-purpose computer lab.

Benefits in a Computer Lab Setting

The ability to create several virtual machines on one host computer can solve many problems that are specific to a computer lab environment. In addition to being an economical approach, another major benefit is that it can minimize or prevent disruptions of the regular lab. These problems are sometimes caused by the more advanced technological courses that traditionally push the envelope for the computer lab technology and oftentimes operate at the edge of the constraints built into the system. This approach also allows the students to keep their work completely isolated on their own drive system while keeping the lab protected by not allowing interference with the traditional lab functions. The ability to clone a virtual machine can also be helpful in the lab when you need to restore someone to a known condition or start everyone off at a particular point in a process.

In the more advanced technology-related courses one has issues where a traditional lab set-up has constraints that make it difficult to conduct these classes in a realistic manner. A computer networking class is a good example because it requires the use of a server operating system with administrator level access to the system. Allowing the students that level of access in a traditional computer lab arrangement is not only ill-advised it can be out and out disastrous. Another information system topic where a similar issue exists would be Web development classes where a fair amount of access to the operating system is needed and one needs to have a setup that is somewhat different from that required for the more traditional classes. Higher level database classes face similar constraints whereby the users only get to operate within a static setup that's handled by the tech support personnel. In many of these cases the students do not get to experience the installation of the software or the setup of the operating system. Virtualization overcomes that constraint

One concern in teaching with technology is that we might become too closely connected or even locked into a single platform or a single operating systems vendor. With virtualization technology, it is easy to work with several operating systems at the same time. We can also explore several different software applications without the need to re-configure the computer lab.

CONCLUDING REMARKS

So far into this arrangement (2 years) we have not experienced any significant issues. We have found that adding additional virtual machines will decrease the overall performance of the system but the impact was minimal. Our machines were purchased as stand-alone units and virtualization was added later. However, when we upgraded from XP Pro to Windows 7 there was a noticeable decrease in performance. We found that using a 4GB flash drive with Ready Boost for additional cache memory helped a great deal. For a new installation, a memory upgrade is strongly recommended. It should also be noted that Marshall Breeding (2009) cited problems with virtualization during high usage in a library setting. Overall, all parties are very satisfied with this solution to what used to be a difficult situation.

References are available upon request from James M. Henson.

HUMAN RESOURCE PRACTITIONERS, WORKPLACE LEARNING, AND EVIDENCE-BASED MANAGEMENT: A PRELIMINARY ANALYSIS

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ABSTRACT

This paper considers the impact on HRM practitioners' workplace learning and evidence-based management as a result of membership in professional organizations, participation in scholarly conferences, reading scholarly journals, and conducting research. Results of in-depth interviews with 13 human resources managers in Halifax, Nova Scotia, are presented. Findings suggest that HRM practitioners tend to participate in professional organizations and develop their networks, but learning tends to be broad and general. Participants favored professional over academic conferences and cited reading as an effective learning strategy. Findings, implications, and future directions for research are discussed.

INTRODUCTION

Organizations have long operated in environments that have changed quickly, dramatically and frequently, and some suggest that the unpredictable nature of organizational environments is increasing [11]. Within these environments, there are numerous broad-brush trends that can affect organizations. For example, globalization [1] [14] [29], technology change [1], and changing workforce demographics [1] are cited by numerous writers in textbooks and professional and academic sources.

In addition to changing environments and organizations, some suggest that the human resource management (HRM) function has shifted from a narrow personnel view to a broader HRM perspective and then to a more strategic orientation (see [28] for a discussion of this issue). This strategic human resource management (SHRM) orientation is emphasized by a number of writers across various components of the HRM field, for example, recruitment and selection [6], training and development [25], and compensation [19].

Given the environmental and role changes and the demands to show the value of HRM, HRM practitioners have had to take on new roles and develop new competencies. They have had to become more global in their orientation and, for example, learn how to develop global leaders [18] as well as compete for global talent [16]. Changes in technology have resulted in adjustments in how traditional HRM activities such as training and development are conducted. For example, HRM practitioners must be familiar with e-learning and other technologies to train and develop talent [9]. Changing demographic trends, for example, having various generational

groups in the workforce at one time, each with different preferences for benefits, has required HRM practitioners to develop tailored benefit plans that can be used to attract and retain talent [3]. Further, in their new strategic roles, HRM practitioners must learn to become change manager and business ally as well as strategist [29]. HRM practitioners must also become “talent and succession managers” providing professional and technical expertise [1] [13] [29], but they must also ensure that senior managers are active in managing this process [1]. HRM practitioners now occupy roles as “learning managers” as opposed to “training suppliers” [20] [26] as well as those of “ethics champions” [16]. The changes in roles have resulted in the requirement for the development of new competencies such as hard-core business competencies [17], but many practitioners also require generic management competencies such as communication, coaching, influencing, and understanding [4]. There is some evidence to suggest that HRM practitioners are assuming roles that are more strategic than those that they have held in the past as well as developing new knowledge and skills to improve their practice [4]. This skill and knowledge development by HRM practitioners is explored in this paper in terms of two related and perhaps overlapping themes – workplace learning and evidence-based management.

It is reasonable to investigate the workplace learning of HRM practitioners given the changes in roles and skills identified above. Further, in Canada there were approximately 40,000 HRM practitioners by 2000, and they do make important contributions to organizational effectiveness [27]. Further, the field of HRM practice is rapidly professionalizing with the development of the standards exemplified by the Certified Human Resources Professional (CHRP) designation. In fact, 21,000 practicing Canadian HRM professionals hold the CHRP designation at this point [2].

HRM Practitioners and Workplace Learning

Workplace learning has been shown to be very important in the development of HRM practitioners’ professional practice [5]. Workplace learning is “a process whereby people, as a function of completing their organizational tasks and roles, acquire knowledge, skills, and attitudes that enhance individual and organizational performance” [12, p. 64]. Similar to other professional groups (e.g., lawyers, teachers, organizational managers), HRM practitioners have tended to use a variety of formal and informal workplace learning strategies and learned from doing their work and interacting with others, often those in similar roles. They also faced barriers to learning similar to those of other groups, for example, lack of time, high workload, and lack of money and other resources. In addition, facilitators of learning such as learning with and from others, organizational and managerial support, and increased resources such as technology were identified by HRM practitioners as important [5]. HRM practitioners are very similar to other professional groups in terms of their workplace learning strategies, barriers and facilitators.

Participation in formal professional/trade associations by organizational managers [7] has been identified as a workplace learning strategy. However, which associations joined, or what was learned and how it affected professional practice was not made clear. Further, this is an area that has undergone little examination in a workplace learning context particularly with respect to HRM practitioners.

Clearly, HR is a field that is engaged in professionalization, and professional HR associations around the world have participated in creating a “specialist body of knowledge, regulating

practice and providing a source of internal and external identity” [8, p. 33]. From a workplace-learning perspective, it seems reasonable to ask if HRM practitioners belong to these organizations, and if they do, how does membership affect their practice?

HRM Practitioners and Evidence-Based Management

Evidence-based management (EBM) refers to a process of “... using the best systematically reviewed evidence available from published research to make decisions about how to manage people and organizations” [22, p. 32]. There have been calls for the use of EBM by HR practitioners [21]; however, “the gap between science and practice is so persistent and pervasive that some have despaired of it ever being narrowed” [24, p. 987]. Despite this, there are some signs that EBM might be catching on in some areas of HRM practice [10]. In fact, one learning strategy that relates to both EBM and workplace learning is that of reading. Reading by accountants [12] and by organizational managers [7] has also been identified as a workplace learning strategy. Again, what was read or what was learned and how it affected professional practice was not apparent. Thus another area that has not been examined in a workplace learning context particularly with respect to HRM practitioners is their participation in professional or academic conferences or learning through the published academic literature related to HRM. Do HRM practitioners attend academic conferences, and do they read the scientific findings? Further, given that doing one’s own research can be part of the EBM process [22], do HRM practitioners conduct their own research (or contract research), and if so, what is its impact on professional practice?

In summary, the questions for this study’s participants are:

1. Do you belong to any professional HRM organizations?
2. Do you attend any scholarly conferences on HRM?
3. Do you subscribe to any scholarly journals/articles on HRM practice?
4. Have you conducted or contracted HR research for your organization?

For each positive response, participants were further asked to identify the organizations and journals, for example, by name and to comment on how, if at all, this type of activity affected their professional/organizational practice. Similarly, for negative responses, participants were asked why they did not pursue that activity.

METHODOLOGY

The methodology used in this study was qualitative and exploratory in nature and was intended to examine a number of case studies based in part on procedures outlined by Lofland and Lofland [15]. For example, these were direct, face-to-face encounters that provided rich detail. The case study approach was appropriate because 1) it answered questions such as “what,” “how,” and “why” regarding workplace learning, 2) the investigators had little or no control over events within the sites to be studied, and 3) events in a real-life context were under study [30].

The study’s findings are based on in-depth interviews with 13 HRM managers in a variety of organizational contexts in the Halifax Regional Municipality (a major government, retail, industrial, military, university and health-care center in the Atlantic provinces of Canada).

Organizations were selected from several sources: the Halifax Chamber of Commerce Business Directory, the local telephone directory, various websites, and assorted media reports. The intent of the authors was to increase the variation of the sample, and thus participation was sought from HR managers in organizations from various sectors such as government, military, health care, and business, to name a few.

In total 20 letters were sent between July 2008 and September 2008 to human resource managers at these organizations explaining the study and inviting them to participate. Ultimately these managers were contacted by telephone by the researchers to determine their willingness to participate. At that point an interview was arranged for a mutually convenient time and place for those who agreed to participate in the study.

A pre-test of the interview guide resulted in minor revisions to improve clarity. Interviews were then completed using an interview guide consisting of open-ended and closed-ended questions to determine selected demographic and organization information as well as issues related to trends impacting the profession and shifts in professional roles and competencies. Interviews took approximately 60 minutes, were tape-recorded and were transcribed verbatim. The interviews were then coded and analyzed on a qualitative basis.

Participants and Their Organizations

The managers who participated in this study represented a diverse group across several quite different organizations. Participants are identified by number to protect their identities, and participants and their organizations are briefly described below:

Participant 1 is a female Director of Human Resources at a post-secondary educational institution with approximately 500 full-time employees. This Director is a generalist with 20 years of full-time work experience in the field of HRM. She holds a BA, BEd, MBA, and CHRP.

Participant 2 is a female Human Resource Manager at a health-care facility with approximately 1,000 full-time and part-time employees. This manager is a combined generalist and specialist (recruitment and labour issues) with six years of full-time work experience in the field of HRM. She holds a Certificate in Adult Education and several professional credentials including Professional Recruiter, IPM, and Psychometrics Professional Assessor.

Participant 3 is a female Human Resource Director in a federal government department with 44,000 full-time employees. This director is a combined generalist and specialist (advising senior managers on all HRM areas) with four years of full-time work experience in the field of HRM. She holds an undergraduate degree and a professional accounting designation.

Participant 4 is a female Senior Vice-President of Human Resources in a diversified group of companies with 3,500 employees. This vice-president has a BA and an MBA and has worked in management and HRM for 25 years.

Participant 5 is a female Director of Employee Services in a post-secondary educational institution with 1,700 employees. This director has a BA, a Certificate in Personnel

Management and a Certificate in Human Resources Management and 20 years' experience in HRM.

Participant 6 is a female Senior Director, Human Resources in a high-tech consulting firm with 600 employees in Canada and 1,400 worldwide. This director is a generalist, has a CHRP and has 15 years' experience in HRM.

Participant 7 is a female Vice President, Human Resources in a firm in the energy business with approximately 2,600 employees. This director is a generalist/specialist (labour relations) who holds a BA, LLB, MBA and a CHRP designation. She has 16 years' experience in HRM.

Participant 8 is an HRM manager with a high-tech firm that has more than 500 employees in Atlantic Canada. She is a generalist/specialist with a college diploma and 12 years' experience in HRM.

Participant 9 is a male HRM generalist in a professional services firm with 1,500 employees. He holds a BBA and several professional certificates and has 25 years' experience in HRM.

Participant 10 is a male generalist/specialist (labour relations) in a communications/information technology firm with more than 9,000 employees. He holds a BBA and several professional credentials and diplomas and has more than 10 years' experience in HRM.

Participant 11 is a female generalist in a professional services firm with 7,000 employees. She holds a PCP designation and has 15 years' experience in HRM.

Participant 12 is a female generalist in a professional services firm with 120 employees. She has a BComm, a certificate in HRM and 20 years of experience in HRM.

Participant 13 is a female HR generalist in a firm in the tourism and hospitality industry with approximately 1,200 employees. She holds a BComm and an HR certificate and has three years' experience in HRM.

RESULTS

Participants were asked, "Do you belong to any professional HRM organizations?" Of the 13 participants, 3 (23%) said "No" and 10 (77%) said "Yes." Ten different professional groups were identified, but the group that 9 (69%) participants identified was the Human Resource Association of Nova Scotia (HRANS). The three participants who indicated that they did not belong cited a variety of reasons including one who said, "when I first came to NS, I found that it really didn't have a lot to offer. It wasn't what I was looking for" and another who found that she was "just not seeing the value in it." The third indicated a lack of participation "because she's new to role."

Those participants who indicated that they did belong to professional groups were asked, "Why do you belong and has this type of activity affected your professional/organizational practice? If so, how?" Participants identified a variety of reasons for belonging to professional groups including supporting the local association, high quality programming, providing an opportunity to give back to the profession, requirement of the job, a source of HR talent, a way to grow HR

practice, and personal satisfaction and growth. However, the two main reasons for membership, which are connected, were learning, identified by eight (62%) of the participants and networking, identified by six (46%) of the participants.

In terms of learning, one participant said, "It's given me a much broader perspective on issues, topics and solutions and viable solutions and also different perspectives on nationally organized unions and it's given me the confidence that when I hear some of the issues that our unions are having that I don't feel like I'm out on an island by myself and I'm the only one that has this problem. I find many of the problems that I have to be very common with other organizations and their unions."

In terms of networking, one participant said she "joined to network," and another said, "particularly good place for networking for younger people entering the profession." However, the link between learning and networking is highlighted by one participant who indicated that "it was a really good learning experience for me. A lot of relationships with people across Canada and the US were developed," and he learned a great deal especially through meetings and networking.

However, participation in professional groups tends to have a broad impact on professional practice, and as one participant suggested, "it still helps me in my job, of course, but it's on a more broader scale ... keeps my mind thinking of things in different ways." Another stays with her professional group because it keeps her up to date with the latest trends and changes within the payroll environment. Two participants did indicate specific impact on professional practice. One said, "Because I get regular communication from that organization, even about HR job postings," she then knows what other companies are looking for in HR practitioners and she can compare it to what her firm is seeking. Another said, "so that I know what's happening in the industry ... because then we can make sure that all our hotels in the area are competitive with all the other hotels."

Two participants indicated that participation in professional groups had little or no effect, and one participant indicated that initially it was a good thing, "but I don't have a whole lot of interest in it now. I am more interested in what a professional person has to tell me."

Participants were asked, "Do you attend any scholarly conferences on HRM? If not, why not?" Of the 13 participants, 8 (62%) said "No" and 5 (38%) said "Yes." Of the eight who do not attend scholarly conferences, three participants (38%) indicated that time constraints were a factor in preventing their attendance, two (25%) said that they did not know about them, one (12%) said that she was not invited, and one (12%) indicated that her focus had changed to more business-to-business conferences. One (12%) provided no particular reason for not attending.

The five participants who have attended scholarly conferences did so for various reasons; for example, one said she attended to maintain recency in the field and to try to make connections between the concepts and the practice of HR. Another felt that most conferences related more to her organization's business (education). Another indicated that he attended conferences because "he loves being challenged by people who have different points of view."

Participants were asked, “Has this type of activity affected your professional/organizational practice? If so, how?” The main impact on practice, identified by three participants, seemed to be based on learning different points of view and what other organizations are doing although, as one suggested, “the academic side could probably be more relevant ... how can something that is academic be taken and then applied.”

Participants were asked, “Do you subscribe to any scholarly journals/articles on HRM practice? If not, why not? If so, which ones?” In response to the first question, eight (62%) indicated that they subscribe to a variety of journals and articles on HRM practice. The dominant one was Canadian HR Reporter with seven of eight (88%) listing this publication. Others included Harvard Business Review (2), HR Leadership Council (2), and Canadian Pension and Benefits, Employment Law, HR.Com, and Human Capital, all with one mention each. In addition, four participants identified other sources of articles including online libraries and publications.

Five participants indicated that they did not subscribe, but three of them said they have articles forwarded to them by colleagues or that they “loosely” follow the literature. One participant suggested that a lack of resources was to blame for no subscriptions.

Participants were also asked, “Has this type of activity affected your professional/organizational practice? If so, how?” Several participants identified more than one impact, and in total 14 impacts were described, all of which related to knowledge in some sense. The most common factor, identified by six participants, was learning about other businesses. For example, one participant said, “I can see what other businesses are doing . . . helps me look at different ways of doing practices that I have or want to do.” A second main impact, identified by six participants, was related to knowledge acquisition and included developing a knowledge base, keeping up to date on news, sharing information, identifying the latest cases and trends, and gaining breadth and understanding. For example, one participant spoke of an internet opportunity whereby “a group of HR individuals share information across the Internet. I can post questions and get responses . . . easy and quick.” Three participants identified impacts that were related to action including developing a base for action, gaining evidence for promoting certain strategies, and providing research for innovations and developments. For example, one participant reported that “it gives me more hard evidence when I’m trying to promote certain strategies or my staff is working on something I can pass along an article related to that subject that they can think about in terms of this is what another organization has done relative to the same issue we’re facing...”

Participants were asked, “Have you conducted or contracted HR research for your organization? If so, which types?” Of the 13 participants, 4 (31%) said “No” and 9 (69%) said “Yes.” A broad array of research topics was identified including leadership development, employee pride, employee evaluation, employment equity, benchmarking process improvement, employee values, and stress management. However, the most common areas of research by these practitioners focused on compensation and benefits and employee engagement with four (31%) and three (23%) participants reporting these areas respectively. Much of this research involved employee surveys and interviews and did involve external consultants in some instances.

Participants were then asked, “Has this type of activity affected your professional/organizational practice? If so, how?” Six (67%) of the nine participants who had conducted some form of research in their HR role indicated that the research had been helpful. One participant spoke in

terms of process: the “key is you need to manage the project and determine the scope; don’t hand it over to the consultants. There’s a place for third party partnerships, but defining relationship up front and roles and scope is critical in order to ensure it is effective and cost effective.” Some spoke of broad and general impacts such as, “Gave us the information we were looking for,” and another said, “What’s happening ... where I need to be to keep happy or at least semi-happy at least not on the sidewalk.” However, two were more specific in terms of impact, and one indicated that research “has helped them to put programs like fitness and health in place.” Another said that he “can figure out what is important for employees and what needs to be changed.” However, one participant, whose research was less structured than that of others, was asked on what basis she developed OD or team-building activities. She replied, “An intuitive approach based on reading, observations, practice ...” The impact on practice is there nonetheless.

DISCUSSION

Given the changes in organizational environments [11], the changes in the HR role [28], and the changes within HR [25], there is no doubt that HR practitioners have a need to learn. As informal workplace learning has been found to be very important to HR practitioners [5], it is appropriate that some key ways of informal workplace learning be explored in this study.

Ten of 13 (77%) practitioners participate in a professional HRM organization, and this type of membership is important to HR practitioners. The main reasons for belonging were networking and learning, and eight of the ten felt that membership affected their professional practice. This is encouraging and implies that professional HR associations are valuable to HRM practitioners. There are, however, three participants who do not belong to any professional HR organization and two who do belong but find the membership has little or no effect on their practice. Also, the learning tended to be broad based and somewhat general. Do professional HR organizations have a broader role to play in the continuing professional development of HR managers? It may be time for HR professional organizations to re-evaluate their services and offerings, in light of the expanded role of HR practitioners and in light of the importance of evidence-based management. According to Rynes [23],

In my view setting up interactive sessions in which academics and practitioners can work together on important problems is probably the most important thing that our professional associations can do to narrow the gap [p. 1050].

Rynes [23] also quoted others who advocate actions that professional HRM associations might engage in such as invite the press to conferences, help build and maintain collaborative EBM web sites, incorporate more research-based content into their certification programs, and present awards from professional associations for research that advances practice.

As only five of the 13 participants indicated that they attended scholarly conferences, it is not a widely used approach to learning about current research in the field. If evidence-based management is to be encouraged, HR practitioners need to learn about the evidence that has been developed by both practitioners and academics. The ones who did attend academic conferences seemed to benefit although in a broad sense which related to a comment that the academic conferences could be more relevant. Assuming that the research results presented at academic

conferences contribute to the evidence or knowledge upon which to base HR management, how can participation at such conferences be increased? The reasons why other HR practitioners did not attend academic conferences varied and included a lack of time, not knowing about them, not being invited, and developing a different focus. One suggestion to bridge the gap between practitioners and academics would be to have a joint industry/academic conference with different streams to appeal to each group and with the option to attend any session and to receive proceedings from all sessions. Practitioners could learn the results of recent research which in turn is evidence on which to base practice, and academics could learn the issues facing practitioners and be exposed to new research questions. Another suggestion would be for the organizers of academic conferences to encourage HR practitioners to attend and have at least one session where research results are applied to current HR issues. These suggestions are consistent with those suggestions of others who reported on a forum on the research-practice gap in HR management and suggested that professional organizations can facilitate interaction with and connection between academics and practitioners [23]. The examples suggested by forum participants regarding academic conferences include focus groups/symposiums on the gap itself, annual conferences, facilitating dialogue between scholars and practitioners on research projects, establishing internet links between publications, and inviting the press to conferences [23].

Informal learning is often accomplished through reading, and eight of the 13 participants engaged in this type of learning. Other research studies [12] also found that reading is one of the workplace strategies used. This form of learning appears to be very useful to the participants as 14 different impacts were noted by the eight participants. All of the impacts involved knowledge in some sense and ranged from broad impacts to very specific impacts such as using the knowledge to support strategies. What is interesting is that the sources listed by participants tended mainly to be other practitioners or practitioner-focused publications and not scholarly journals. Although practitioner publications are quite useful, the HR practitioners in our study were not accessing scholarly journals. One study looked at whether or not practitioners are exposed to academic research findings, and if so, are the articles they read consistent with the research findings and is the research being conducted relevant to practitioners [24]? Findings indicated that evidence-based management does not appear to be widely used in the HR management field, and Rynes, Giluk and Brown concluded,

Our results suggest that: (1) Practitioner and bridge journals provide little coverage of some of the research findings deemed most important by HR researchers and (2) when they do offer coverage, the messages they transmit are sometimes very different from the ones a reader would find in peer-reviewed academic journals [24, p. 1004].

This study did not study the reverse gap, that the research conducted may not be on topics of the greatest importance to practitioners. However, the researchers referred to a recent study that indicated that the reverse gap is large [24].

If evidence-based management is to succeed, then the research must be of relevance to practitioners, and suggestions made earlier regarding joint conferences would help in this area. Other suggestions that could be initiated by researchers were categorized as (1) ways to increase relevance, usefulness and interest to practitioners which includes involving practitioners with research, finding out about areas of research interest to practitioners, writing articles for

practitioner journals, serving on the editorial board of bridge periodicals, improving the communication of research findings, and considering the role of qualitative research; (2) the need for more direct study of research translation and knowledge transfer processes, that is, why practitioners don't believe and/or implement research findings and how to communicate findings so that findings are believed and effect change and (3) methods to expand or modify publication outlets and formats such as researchers watching trends to ensure their research areas are relevant, disseminating new knowledge more quickly, using arenas (websites, for example) other than journals/publications, ensuring journal articles include implications for practice and for management education, having top tier journals accept articles that do not have a contribution to theory, and incorporating research findings in courses and textbooks [23].

This list of ways to bridge the gap between research and practice as well as the reverse gap indicates that efforts must be made by both researchers and by professional organizations so that the material that is read by practitioners is relevant to them, includes research results and is communicated in a way and in a forum that they find accessible and useful.

From an evidence-based management approach, it is encouraging that nine of the 13 participants indicated that they had conducted or contracted HR research for their organization. The topics covered an array of areas from leadership development to stress management; however, they focused mainly on compensation/benefits and employee engagement. This finding is consistent with others who reported that there are signs that EBM might be catching on in HR [10]. However, another study suggested that most of the participants conducted the research as opposed to contracting it out, and doing one's own research is part of the EBM process [22]. Six of the nine participants in this study indicated that the research was helpful. That means seven of the 13 participants hadn't conducted/contracted any HR research or did so but found the results to lack value. Perhaps there is a need for seminars/conference sessions on how to identify and structure a research project, how to engage consultants in the research process and how to apply research findings to the HR function. There could also be an opportunity for practitioner/academic research projects, but first there needs to be a way for researchers and practitioners to interact, and that could be facilitated in a number of ways, for example, including a practitioner stream at academic conferences or a researcher stream at practitioner conferences.

LIMITATIONS AND FUTURE RESEARCH

This study was a qualitative study with a small group of HR managers in one geographical area. Future research could be conducted quantitatively on a large group and in other regions of the country. Such research might also investigate the areas that HR managers feel are important to research as well as document their sources of evidence or knowledge and how they use such evidence in making policy decisions. In addition, academic and practitioner associations and journals need to discuss how they can start to bridge the gap between research and practice in the human resource management field.

Much has been written in recent years about evidence-based management (EBM) and its role in various professions such as nursing, medicine, and coaching. Many writers suggest that EBM could and should be applied to the field of management [22], especially in the area of human resource management [10] [21].

This article has reported on how evidence-based management is experienced by a group of HR practitioners and has provided some suggestions both for academics and practitioners in order to encourage EBM in the human resource field.

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MADE FROM SCRATCH

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ABSTRACT

Management, above all, is the controlling element responsible for coordinating the three basic business functions that include production, marketing, and finance. Mechanisms exist to facilitate the finance function with influence coming from outside regulatory bodies such as the AICPA, IIA, SEC, and other federal regulators. Integrating the finance function into organizations, then, becomes somewhat generic (although some would argue this point). Coordinating the functions of marketing and production is a much more difficult endeavor. This paper suggests employing a more user-focused approach as a means to improving the overall quality of products, and eventually, the success of the organization.

INTRODUCTION

Every organization, profit or non-profit, engages in three basic business functions; production, marketing, and finance. Simply put, production is engaged in transforming inputs into outputs. Marketing is concerned with communication—publics to organization, organization to publics, and intra-organization. Finance is responsible for tracking the flow of resources through the organization's environment. Complex mechanisms are constructed to accommodate these basic functions, but at their root, their focus is: *make stuff, talk about stuff, and track stuff*. Management's role is one of coordinating these three functions.

An old adage suggests marketing wants the production department to “produce what we can sell” while production wants marketing to “sell all we can produce”. This paper suggests the underlying problem in producing quality products may be the disconnection between the desires of the consumers and the producers. Failing to recognize the factors affecting consumer preferences can lead to producing items that simply don't fit underlying needs. One way to address this is to incorporate a discipline used by designers into the mix, where the user becomes

a key input in the decision making processes. They rely on an anthropological approach, called contextual research, to understanding user needs and wants, which informs a design-build-evaluate cycle eventuating in a product with a good fit. This “fit” meets the needs/wants of the end user, but also satisfies the aims of the firm to produce ethical products that are profitable.

This paper looks at some variables that influence product selection from several directions and emphasizes user-connection to the product as a possible trend in demand. For example, there is an increased interest and attachment to products demonstrating a connection to nature. Not to be confused with environmentalism, the inclusion of “natural elements” in product design has demonstrated benefits, not just in increased sales, but with higher customer satisfaction. Further, building attachment to a product can lead to increased loyalty, which can translate into future sales, but also can serve as a gauge of customer perceptions of firm and product quality. Making the *right stuff* continues to be the challenge for firms. Because this paper proposes potential solutions to this challenge, the next section explores how the human mind accepts natural elements. Then, the focus shifts to the hands-on consumer, and finally, the paper addresses the search for the proper balance in engaging the consumer into the process.

HUMAN EVOLUTION AND THE DESIGN OF PRODUCTS

Humans have evolved with certain natural elements and customized them into tools to work with other natural elements. The human brain responds to these elements in very specific ways. The visual system responds differently to natural scenes (e.g. forests) than to man-made scenes (e.g. strip malls) (Coppola, White, Fitzpatrick & Purves, 1998). The olfactory system responds to complex natural odors differently than isolated chemicals used by scientists and manufacturers (Lin, Shea, Katz, 2006). Many of these reactions reflect simple variation in the normal spectrum of response, and product designers can play with unexpected textures and materials to surprise and delight the senses; however, there are pathological responses to non-natural stimuli, some of which can be debilitating. For example, the blue light emitted from televisions, computers, and even Blackberries disrupts the release of melatonin which, subsequently, interrupts sleep habits (Lockley, Brainard, Czeisler, 2003). The average night’s sleep is 7.5 hours today versus 9 hours in 1900 (Vgontzas, Bixler, Kales, 2000). This may be a boon to the sale of pharmaceutical sleep aids, but opportunities (and demand) for more natural “red” light settings are present for those attuned to the market.

Similarly, the evolution of manufactured goods has included the change in materials. The impossible trilogy, *Cheap-Fast-Good*, has taken advantage of these materials. Plastics, chemicals, and changing technology have shifted the way items are produced, but also the way they look and feel. The migration from tangible to virtual introduces a wonderful new space and exciting new products, but the lure of nature still holds sway. The value of objects made from natural materials is reflected in higher prices, but also in the perceived quality of the object itself. This may be due to the greater amount of work involved in producing using natural elements (perhaps including hand-made aspects), may be implied as a moral valuation, or both.

Ascribing value to objects is the basis for the level of attachment to that object. While the value can derive from the object itself, so too can it be generated by the consumer’s engagement.

OWNERSHIP AND RESPONSIBILITY: THE HANDS-ON CONUNDRUM

Attachment to products comes from the level of ownership and responsibility assumed by the consumer. Ownership can reside in holding the title or deed to personal or real property, but in the goods market, the sales receipt may not be enough. Owning means holding a personal claim on the object, and with that comes the responsibility to care for it. A few examples might help clarify this relationship.

In the 1950s, Betty Crocker sought to streamline the cake-making process by introducing “instant cake mix”. The mix required only the addition of water. Housewives of the time didn’t like the idea. The lack of investing effort into the process made it less than desirable. The subsequent modification allowed the baker to add an egg (and later, cooking oil). Doing so provided the sense of ownership, and thus attachment to the product—the cake, in this instance.

The largest retail do-it-yourself furniture company gets it. Inexpensive—some say cheap—furniture that is flat-packed, picked by the customer from the racks, taken home, and put together by the customer is the means to an end. Assembling the furniture is a short step removed from *building* it, and this level of involvement creates such a level of pride of completion, ownership is claimed. Sometimes called the *IKEA effect*, engagement is the key to attachment. Owners of this product proudly display it, take pride in it, and are reluctant to discard it (Airely 2010).

Home Depot, the largest home improvement specialty retailer is also the fourth largest retailer in the US; but one can also look to the success of craft stores and small-scale DIY projects to exemplify the lasting and gratifying nature of the *Ikea effect*. A Cub Scout pinewood derby is an event where the Cub Scouts *build* a small car using a boxed set of elements that includes a block of soft pine, 4 small nails, and 4 plastic wheels. They carve their own body shape, paint the cars and apply decals, use small nails as axles for the plastic wheels, and add small lead weights to meet design criteria. Once built, they gather to “race” their cars down a pre-built track. The fastest car wins the trophy. The real prize, however, is the pride displayed by the boys (and their parents—some of which were instrumental in building the car) when everyone has a good look at all the cars. The “show and tell” overshadows the race in importance. Many attics and storage closets contain pinewood derby cars that date back many years. The level of attachment to those painted blocks of wood arises from the effort employed to produce them.

There is an evolving literature on *effort-based rewards* (Lambert 2008). Simply put, engagement and effort stimulate the pleasure pathways of the brain, thus rewarding the behavior. These pathways evolved from thousands of years of hunting, gathering, farming, chopping, grinding, and cooking foods, as well as building shelters, creating and cleaning objects to furnish those shelters and deliver these foods, creating usable fabrics, and generating other necessities of life. Linking these challenging endeavors with the pleasurable sensations of being warm, dry, full is an important function of the brain to encourage the person to continue in their efforts. Much of modern work is virtual; however the brain has not yet evolved to associate hours of computer time or a credit card swipe at Wal-mart with contented sensations. If products can be developed

that encourage some level of physical effort on the part of the consumer, reward pathways may be triggered and the level of attachment –or loyalty- could be enhanced.

Not too much, though...

On the other hand, too much ownership and responsibility can be a bad thing. Involvement, engagement, and effort can facilitate attachment, but the on-going responsibility to maintenance may out-strip the consumer's ability, and, therefore, attachment. Additionally, the ease of engagement can facilitate taking true ownership. The easier the involvement: the stronger the sense of ownership. Anything that limits easy connection to the product, can serve as a barrier to attachment. For example, without an elemental understanding of the materials, the consumer may be challenged to fix the item if it breaks. Further, in such settings, there may be no-one to call who can fix it.

Similarly, if the DIY product is too difficult to assemble or the assembly requires specialty tools, attachment can be thwarted. Equally destructive is the case where the instructions are not intuitively understood. Many can identify with the feeling of helplessness when faced with hundreds of parts—including nuts, bolts, and screws- strewn across the floor (perhaps late the night before one hopes to give the gift to a child). The picture on the box looks like a wagon, but the instructions- written in a loosely-defined version of English, punctuated by an iconic language interpretable only by the illustrator- provide little help. Once completed, there is much relief, but little attachment to the final product.

Customization is often touted as a way to build attachment, but perils lie here, too. On the one hand, ownership through personal identification with the object can result from selecting such variables as color, finish, and other accoutrements, but when selecting from a restricted set of options, uniqueness is not guaranteed, and neither is a strong sense of attachment. On the other, the more personal (and unique), the more attachment.

IN SEARCH OF AN ANSWER

There is a difficult balance to be struck in making the design decisions. Consumers make decisions using their time to investigate options and their money to purchase products. The trade-offs are evinced in selecting expensive products offering performance guarantees and service after the sale against the less expensive, throw-away products. However, the *IKEA effect* demonstrates the impact attachment has even with cheaper products, so the trade-offs are not as clear-cut as might be assumed.

In much the same way, the hands-on aspect of products creates an uncertain outcome. Up to a point, engagement in building the product creates attachment, but too much effort reduces the connection, and thus the reward. And hands-on is not limited to the assembly of the product. The visual and tactile perceptions of the product provide a source of feedback that, in itself, is a reward for ownership.

Involving the user is a fundamental approach in creating products that will meet the perceived needs and wants of the consumer. Significant contextual research, examining the underlying

motives of the consumers, is an important and often neglected step in the process. Prototyping products and putting them in the hands of users is a simple, but necessary way to evaluate the efficacy of the product, and also to gauge the level of attachment they feel. Feedback from the practical testing of prototypes informs the next level of design, which, in turn, generates new prototypes, and the cycle continues. Beyer and Holzblatt (p. 54) suggest “A process is truly customer centered when customers can change designers’ initial understanding of the work.” Applying this approach avoids the often observed, “them that designed it should have to use it...”

Another important component of contextual research is thorough follow-up with consumers. Many companies shorthand this process by asking them to complete customer satisfaction surveys, but these surveys rarely allow for meaningful or open-ended feedback. Interactive follow-up may help manufacturers address small changes that could significantly improve product design.

A number of firms are recognizing the potential for smaller market segments and moving away from “one size fits all” mentality. The “limited customization” approach employed today is a step in that direction, and more applications are being introduced via web access. In this way, small batch production can be applied in efficient ways.

THE BENEFITS OF INCLUDING THE USER

Net benefits accrue to producing output that meets consumer expectations. As suggested, contextual research affords the needed information that shapes the prototypes, and eventually, the end products that fit the user’s core needs. Kuniavsky (2003) offers five reasons for relying on a user-centered process.

- 1. Efficiency. Products that people actually want don’t have to be remade. Products that are designed around the way people work don’t need to be changed. When there’s a model of how people use a product, there will be fewer disagreements, less ambiguity, less development delay, and you’ll know just where to add functionality (and where not too)*
- 2. Reputation. Users who have a positive user experience are more likely to keep using your product and to tell others to use your product. Products that match people’s needs, desires, and abilities will create a level of satisfaction that goes beyond mere complacency and acquires an aura that extends beyond functionality. People associate themselves emotionally with the product, creating a bond that’s much stronger than one that’s merely based on rational functional trade-off.*
- 3. Competitive Advantage. The more detailed the user model, the more easily it’s possible to know which of their needs your product satisfies. This makes it possible to identify needs that are unfulfilled by the competition and drive innovation not based on technological capabilities (which may or may not have practical*

applications) but on real needs (which certainly do). Rather than reacting to user behavior, you can anticipate it and drive it.

4. *Trust. When a product behaves according to people's expectations and abilities, they trust it more. Trustworthiness, in turn, leads to loyalty, satisfaction, and patience.*
5. *Profit. Ultimately, when a product costs less to make, costs less to maintain, attracts more customers, and provides better value to business partners (all things that are explicit goals of user experience research and design), it makes more money.*

Some obvious benefits of including the user in the design process include improved communication, both inside and outside the firm; fewer customer complaints; higher perceived quality (with lower quality control costs); smoother scheduling in production due to reduced demand forecast errors; predictable development costs; more solid branding opportunities; improved responsiveness to market changes; and overall improvements in efficiency, which translates into greater control over all costs, affording pricing controls and/or improved profitability.

It may be a result of the on-going recession and a societal emphasis on environmentalism, or perhaps a deeper biological need unmet by today's virtual world, but consumers seem anxious to connect with their products in ways that result in longer-term ownership. Managing the process with this in mind is one way toward future success in product development.

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**OPERATING STRATEGIES AND ECONOMIC FACTORS IN THE AIRLINE
INDUSTRY: THE SOUTHWEST EFFECT EXTENDED**

Submission: Southeast Decision Sciences Institute 41st Annual Meeting

Program Track: Management, Organizational Behavior, Organizational Theory, and
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OPERATING STRATEGIES AND ECONOMIC FACTORS IN THE AIRLINE INDUSTRY: THE SOUTHWEST EFFECT EXTENDED

Program Track: Management, Organizational Behavior, Organizational Theory, and Human Resource Management

ABSTRACT

Bennett and Craun [2] noted that the presence of Southwest Airlines in the airline market caused changes in the ticket price dynamic of that market. This paper expands on this thesis by evaluating the impact of Southwest Airlines and other low-cost carriers (LCC) on the industries' strategic and economic drivers that have influenced the profit margin of the top ten U.S. airlines. Using operating and financial data retrieved from the Bureau of Transportation Statistics (BTS) Airline Database, we construct a regression model to analyze and explain changes in airline profitability spanning two recession cycles (1999-2009). A subset of operating variables are analyzed, and conclusions are drawn concerning the importance of 'The Southwest Effect' on various industry strategic drivers during this period of dynamic change.

INTRODUCTION

The airline industry has been greatly impacted by two recessionary cycles during the last ten years. Airline revenues declined sharply in mid-2000 in advance of the national recession in 2001 and the events of 9/11 [7]. More recently, the five quarter recession of 2008-2009 has resulted in major restructuring of airline networks and airline employment [3]. In fact, prior to the period of our study, profit margins for the industry averaged 1.6% during the 1980s [11] and only 1% during the 1990s [12]. Industry-wide losses totaled \$7 billion in 2001, \$7.5 billion in 2002, and \$5.3 billion in 2003 [15]. Furthermore, the airline industry is characterized by economic turmoil during this period. In 2005, Delta, Northwest, United, and US Airways were operating under Chapter 11 bankruptcy. US Airways and America West Airlines merged operations beginning in September 2005. United exited Chapter 11 in February of 2006, and Delta emerged from bankruptcy protection in April 2007. Delta and Northwest merged operations beginning in October 2008, and United and Continental recently announced approval to merge their operations [4].

To survive and succeed in the current environment of industry-wide reorganization and consolidation, it is essential for carriers to use research methods that can help improve profitability. Many industry managers look to benchmark the low-cost carriers (LCCs) in areas that improve productivity [5]. Our research seeks to determine if 'The Southwest Effect' [2] can be shown to have a positive effect on those operating variables influencing a carriers ability to lower ticket prices and remain profitable through enhanced productivity. For the airline industry, the definition of productivity continues

to be difficult. For example, Marn [9] concluded that efficiency and network characteristics are the main determinants of airline productivity while *Airline Business* [1] stressed the importance of labor cost in determining overall airline productivity. For some industry analysts, the implication is that high productivity and profits are synonymous with low labor costs [8]. But Schnurman [13] found that Southwest Airlines, the industry's most profitable carrier, has relatively high employee pay for many of its labor categories.

This research considers labor costs in addition to other dynamic airline operating variables and analyzes how airline profit margins are affected by their change. Eleven years (1999-2009) of quarterly data for the top 10 U.S. passenger airlines were tabulated, and variable data believed to be factors in achieving a profit margin were modeled using regression analysis. Those variables thought to have the most impact on productivity and profit margins are summarized.

THE MODEL

The following variables were measured and calculated quarterly from the final quarter of 1998 through the final quarter of 2009:

- Operating Profit Margin – (Profit of Loss)/Total Operating Revenue
- Market Share – Percent of Industry Total
- Operating Expense per Available Seat Mile (ASM)
- Aircraft Utilization per Day
- Percent Pilot Cost – Pilot Salary/Total Salary
- Productivity of Labor – Total Salary and Benefits/Total Operating Expense
- Fuel Cost per Gallon
- Asset Productivity – Aircraft Operating Expense/Available Seat Mile
- Pilot Cost per Available Seat Mile (ASM)
- Labor Cost per ASM
- Aircraft Efficient Use – Aircraft Air Hours/Aircraft Ramp to Ramp Hours
- ACF-Total Assets
- Revenue Productivity of Labor – Revenue/Labor Cost
- Revenue Productivity of Assets – Revenue/Total Assets
- Revenue Productivity of Fuel – Revenue/Fuel Costs
- Aircraft – Number of Aircraft
- Fuel Cost per ASM
- Pilot Cost per Aircraft Hour Ramp to Ramp
- Pilot Cost per Aircraft Hour Airborne
- Non-flying Pilot Costs per Aircraft Hour
- Labor Cost per Aircraft Hour
- Employees per Aircraft
- Pilots per Aircraft
- Quarter 2 (dichotomous indicator)
- Quarter 3 (dichotomous indicator)
- Quarter 3 (dichotomous indicator)

Year of Study (time)
 Number of Quarters since Beginning of Last Recession

RESEARCH METHODOLOGY

Variables from the dataset were tested for their significance as contributing independent predictors of quarterly operating margin in the airline industry. An Ordinary Least Squares (OLS) regression analysis was chosen as an appropriate method for testing the dataset. OLS regression analysis allows researchers to estimate a dependent outcome from a set of variables that are continuous, discrete, or dichotomous or a mix of these type variables [10].

We began our analysis using all the variables in the dataset in a step-wise OLS regression analysis with $p=.05$ to enter and $F = 3.84$. After the step-wise analysis, the regression showed fifteen of the initial variables as being significant in estimating quarterly operating margin. The outcome provided satisfactory goodness-of-fit results ($F = 111.81$, $\text{sig.} = 0.000$) and explanation of model quality statistics ($R^2 = 0.901$, $\text{Adj. } R^2 = 0.812$, $\text{std. error} = 0.046$ and $\text{Durbin-Watson statistic} = 0.797$). Table I presents coefficients, t-values, and significance for the independent variables extracted from the OLS regression. The regression model function is as follows:

$$y = -0.336 - 0.211 x_1 - 5.076 x_2 - 1.466 x_3 + 0.792 x_4 - 20.300 x_5 + 14.108 x_6 + 0.149 x_7 + 0.212 x_8 + 0.007 x_9 + 2.246 x_{10} + 0.001 x_{11} - 0.001 x_{12} + 0.001 x_{13} + 0.010 x_{14} + 0.002 x_{15}$$

Table I – OLS regression results for the dataset

Independent Variables	Coefficient	t-value	Significance
(Constant)	-0.336	-2.848	.005
x_1 – Market Share	-0.211	-2.309	.021
x_2 – Operating Expenses per Mile	-5.076	-9.293	.000
x_3 – Percent Pilot Cost	-1.466	-5.268	.000
x_4 – Productivity of Labor	0.792	4.530	.000
x_5 – Pilot Cost per ASM	-20.300	-5.467	.000
x_6 – Labor Cost per ASM	14.108	7.457	.000
x_7 – Revenue Productivity of Labor	0.149	15.539	.000
x_8 – Revenue Productivity of Assets	0.212	3.418	.001
x_9 – Revenue Productivity of Fuel	0.007	5.103	.000
x_{10} – Fuel Costs per ASM	2.246	3.924	.000
x_{11} – Pilot Cost per Aircraft Hour Ramp to Ramp	0.001	8.265	.000
x_{12} – Labor Cost per Aircraft Hour	-0.001	-8.102	.000
x_{13} – Employees per Aircraft	0.001	2.667	.008
x_{14} – Year of Study (time)	0.010	6.300	.000
x_{15} – Numbers Quarters Since Last Recession	0.002	7.093	.000

PRELIMINARY RESULTS

There are some unexpected results from the regression. First, the marketing literature has shown a high correlation between profitability and market share [14]. Thus, the negative sign on the market share variable is a bit surprising. However, when we take into account diseconomies of scale, diminishing returns, managerial problems [6], and larger firms in the industry generally showing less profit, the negative sign is understandable. We would expect to see negative signs on all the cost variables. However, we see mixed results on this assumption. For instance, pilot cost per ASM has a large negative coefficient -20.300 and t-value -5.467. We would also expect these same results for labor cost per ASM, fuel costs per ASM, pilot cost per aircraft hour ramp to ramp, and employee cost per aircraft, but the signs on the variables are positive. These results are unexpected and will require further research. Two control variables were added to the study. First, the year of the study (time) had a positive sign and a significant t-value. Thus, during the study period there were some non-cost related strategic changes in the industry that lead to improved profitability. Finally, the number of quarters since the last recession had a positive sign and high significance. We would expect this because an economy growing out of recession usually leads to increased travel and thus, more profitability for the airlines.

SUMMARY AND CONCLUSIONS

This analysis of airline productivity data yielded some interesting results that will require more complete analysis. For example, a more complete analysis of the productivity of labor, defined as total salaries and benefits over total operating expenses, is needed. We observed that Southwest Airlines, which was profitable over the entire review period, had steady increases in salaries. However, their labor cost/aircraft hour was low. The data obviously contains complex interactions between cost variables (labor, fuel, etc.) and productivity variables (aircraft utilization, employees per aircraft, etc.).

In order to 'extend' our understanding of the 'Southwest Effect' beyond the currently accepted ticket pricing influence, a more in-depth study of the relationship between various potentially impacting variables and airline profit and productivity is warranted. Expanding the data review is necessary to better explain these preliminary findings.

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Sustainability – Is the Time Right for Its Mass Acceptance?

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Abstract

How many strands of wire must be woven together to make a cable strong enough to hold up a bridge? The sustainability movement includes thousands, perhaps millions, of individual strands, or efforts to improve. Much like the strands of wire, these efforts must be woven together to form a global movement powerful enough to pull individuals, groups, even nations, along in the sustainability effort. The world is waiting for the leadership to weave together the seemingly incompatible interests of business, government, special interest groups and society.

Definitions for Sustainability

The most quoted definition of sustainability, or sustainable development, is the one provided by the Brundtland commission report, *Our Common Future*, that defined sustainable development as “development that meets the need of the present world without compromising the ability of the future generations to meet their own needs.” (Brundtland Commission 1987) This supports the TBL idea that businesses must be concerned about their financial wellbeing (the first bottom line), their contribution to society’s needs (the second bottom line) and their increasing role in managing environmental responsibilities (the third bottom line).

Green supply chain – A supply chain that considers environmental impacts on its operations and takes action to comply with environmental safety regulations and communicate this to customers and partners. See: environmentally responsible business (Blackstone 2008). A green supply chain is concerned with the forward flow of goods from origin to consumer.

Reverse logistics – A complete supply chain dedicated to the reverse flow of products and materials for the purpose of returns, repair, remanufacture, and/or recycling (Blackstone 2008). This reverse supply chain deals with the flow of goods from consumer back toward the origin. See Crandall (2006).

Cradle to grave – A concept that attempts to connect the reverse supply chain with the forward supply chain to show the need for continuity throughout the life cycle of a product. A life cycle assessment (LCA, also known as life cycle analysis, ecobalance, and cradle-to-grave analysis) is the investigation and evaluation of the environmental impacts of a given product or service caused or necessitated by its existence (Wikipedia 2010).

Cradle to cradle - A phrase invented by Walter R. Stahel in the 1970s and popularized by William McDonough and Michael Braungart in their 2002 book of the same name. This framework seeks to create production techniques that are not just efficient but are essentially waste free. In cradle-to-cradle production, all material inputs and outputs are seen either as technical or biological nutrients. Technical nutrients can be recycled or reused with no loss of quality and biological nutrients composted or consumed. By contrast, cradle to grave refers to a company taking responsibility for the disposal of goods it has produced, but not necessarily putting products’ constituent components back into service. (The Sustainability Dictionary 2010)

These terms are only a sampling of the many that are circulating in the literature; however, they represent a progression from a fragmented view of many diverse viewpoints to recognition there is a need for a system, or supply chain, perspective of the sustainability movement. Hawken (2007) describes this fragmented situation. He estimates there are at least one million, perhaps two million, organizations working toward ecological sustainability and social justice. Despite these many efforts, or perhaps because of their lack of collaboration, the sustainability status is more about what individual businesses, or other organizations, are doing than on a movement with widespread attention and support.

Developing a Sustainability Index

A number of businesses are taking the initiative in the sustainability movement. Wal-Mart announced a program to develop a sustainability index, with the ultimate objective to label products with a rating to provide consumers with an indication of the product's environmental and sustainable status. They hope to accomplish this in three phases:

- Phase 1. A supplier assessment, using a 15-question survey provided to each of 100,000 global suppliers. The voluntary survey will help suppliers evaluate their own sustainability efforts in four areas: energy and climate, natural resources, material efficiency, and people and community.
- Phase 2. Development of a sustainability consortium that will integrate information from Phase 1. This consortium will consist of a group of universities that will work with retailers, suppliers, nongovernmental organizations (NGOs) and the government to create a global database of information on the life cycle of products. This index is not just for Wal-Mart, or even the United States, but one that is global involving a variety of stakeholders.
- Phase 3. The implementation of product labels that clearly rate the environmental and sustainable aspects of the product. (Stokes 2009)

While supportive of Wal-Mart's efforts, Stephen Stokes believes there is a need to consider what is achievable, desirable and likely to make a difference in the environment. Rushing to force product labeling prematurely will "result in a lack of standards, expectations and planned outcomes, as well as cause a great deal of consumer confusion." (Stokes 2009, p. 20)

Several issues should be evaluated before proceeding with storewide product labeling:

- Who's watching compliance costs? One study estimated a potential cost of \$10-12 thousand per SKU. At 25,000 SKUs for a typical supermarket, the cost could be upwards of \$250 million, just to determine the carbon footprint.
- What about full product life cycle beyond manufacturer control? Should the labeling be based on cradle-to-gate (factory gate) versus cradle-to-cradle life cycles?
- Are procedures and standards realistic to existing production models? How can recycling (reverse logistics) efforts be included?
- Who can judge environmental claims and performance? Presently, there is no way to verify the calculation and tracking of carbon or environmental information.
- What about the consumer? Although there may be increasing consumer awareness, there is not yet a pull from end consumers.
- What should be the functional unit for analyzing corporate environmental performance? Labeling all SKUs is probably overkill; sampling a subset may be a realistic goal.

Kevin Dooley is another participant in the Sustainability Consortium. He adds the following:

- Can such an index be practical and effective? Simply put, it has to be or it will fail.
- Who gets to determine the score? The Consortium hopes to get participation from a broad coalition of manufacturers and retailers "in a unified effort to define how such scores are calculated and how they're communicated to consumers." (Stokes 2009, p. 21)

Dooley adds it is unlikely that businesses will endorse any sustainability movement if it increases costs. To overcome this obstacle, he believes a holistic, life cycle approach will uncover additional areas of cost reduction beyond that achieved with quality improvement and lean production programs.

Operationalizing Sustainability

Developing a meaningful Sustainability Index may be a long-term goal; this does not preclude businesses from implementing programs to improve their sustainability programs. Many companies still view corporate sustainability and corporate social responsibility as an add-on cost. If so, they may be missing the opportunity for business growth, innovation, and organizational change (Busco et al. 2010).

Beginning in 1999, Proctor & Gamble (P&G) added a strategic objective, to improve their program of sustainable development. P&G's mission became "to provide branded products and services of superior quality and value that improves the lives of the world's consumers, now and for generations to come." (Busco et al. 2010) P&G has provided a Sustainability Report for over 10 years to account for its social and environmental strategy. They also added a Global Sustainability Department to its organization structure. Their sustainability program includes the following components:

- Objectives – what we need to achieve
- Goals – quantitative targets of progress towards objectives
- Strategies – how we will achieve our objectives and goals
- Measures – numerical targets of progress on strategies

They measure their progress using both quantitative and qualitative measures that include not only financial measures but also other aspects of organizational activities.

As a further refinement, in 2007 P&G set up five-year sustainability strategies for five broad areas: products, operations, social responsibility, employees, and stakeholders. One of the major successes was the development of a cool water detergent. They used life-cycle assessment (LCA) to measure the overall environmental effect of the new product from raw materials to disposal. They determined the product had profit potential. Finally, they did a social assessment to determine the benefits for consumers. Along with energy savings and improved cleaning, the campaign offered the additional motivation of supporting the environment in a more sustainable way (Busco et al. 2010).

Benefits of Sustainable Programs

Another study involved in-depth interviews with more than 50 global business leaders, and a survey of more than 1,500 worldwide executives and managers. The survey revealed over 92% of the respondents indicated their company was already addressing sustainability in some way. Over 30% of the respondents indicated improved company or brand image was one of the benefits, although they tended to downplay this as a secondary benefit, compared to the primary benefits associated with value creation, such as new sources of competitive advantage. Other benefits included cost savings, employee satisfaction, product innovation, process innovation, new sources of revenue or cash flow, effective risk management, and enhanced stakeholder relations. The benefits varied from company to company, suggesting no single benefit stands out as common to all programs. (Hopkins et al. 2009)

One benefit gaining traction for sustainability programs is as a driver of innovation. A study of sustainability initiatives at 30 large corporations shows sustainability is a source of organizational and technological innovations that yield both bottom-line (reduced costs) and top-line (increased revenues) returns. Smart companies are treating sustainability as a new frontier in their innovation efforts. As early movers, they are developing competencies their competitors will be hard put to duplicate. The authors suggest the following steps in developing a sustainability program.

- Stage 1. View compliance as opportunity. Comply with the most stringent standards to gain time to improve their materials, technologies, and processes.
- Stage 2. Make value chains sustainable. Analyze each link in the value chain to identify improvement opportunities.
- Stage 3. Design sustainable products and services, in anticipation of increasing consumer acceptance, be the first to redesign existing products or design new ones.
- Stage 4. Develop new business models. Come up with novel ways of delivering services, often in tandem with other companies.

- Stage 5. Create next-practice platforms. One idea is the smart grid, which merges the internet with energy management.

The authors conclude: “The current economic system has placed enormous pressure on the planet while catering to the needs of only about a quarter of the people on it, but over the next decade twice that number will become consumers and producers. Traditional approaches to business will collapse, and companies will have to develop innovative solutions. That will happen only when executives recognize the simple truth: Sustainability = Innovation.” (Nidumolu, Prahalad and Rangaswami 2009).

Obstacles to Sustainability

With successes such as described above, why isn't there a mass movement toward sustainability programs by business and other organizations? Few would dispute that protection of the environment is a desirable objective. While there are a variety of reasons why businesses and governments do not move aggressively toward greater sustainability, the main obstacle boils down to the lack of reliable and meaningful measures of the benefits. We can identify the costs, but we can't come to agreement that the benefits outweigh the costs, at least in the immediate future (usually measured as the expected life of the current CEO or the time until an incumbent faces the next election).

Many companies are convinced the more environmentally friendly they become, the less competitive they will be. They see sustainability as a competitive disadvantage rather than an advantage. Executives in these companies treat the need to become sustainable as a social responsibility, not a business objective. Some suggest that only the federal government can level the playing field by legislating or regulating improvement. Others believe educating and organizing consumers will force companies to become sustainable. (Nidumolu, Prahalad and Rangaswami 2009).

The alternative to collaboration among stakeholders is to await some cataclysmic event – depletion of oil resources, collapse of electric grids, contamination of water or food supplies, or citizen rebellions against government, even in democratic countries. The alternative does not sound remotely acceptable; therefore, it appears we should put more effort into developing meaningful measures for a variety of sustainability issues. To do this, we need a plan.

A Plan

The American Energy Innovation Council (www.americanenergyinnovation.org) is composed of leading business executives, supported by a Technical Review Committee that includes business, academic and governmental representatives. Their mission “is to foster strong economic growth, create jobs in new industries, and reestablish America's energy technology leadership through robust, public investment in the development of clean energy technologies.” (American Energy Innovation Council 2010). In their report “A Business Plan for America's Energy Future,” they stress the need for government involvement in energy because (1) there are significant, quantifiable public benefits, and (2) the energy business requires investments of capital at a scale they is beyond the risk threshold of most private-sector investors. They provide a number of specific recommendations. While it is only for one industry (energy), it represents a major attempt by high-profile business leaders to formulate a sustainable approach to the sustainability issue.

Conclusions

Other articles describe ways to move the sustainability movement forward. The principal stakeholders and participants are government, business, special interest groups, and consumers. They must come to some consensus about the direction of the sustainability movement and some of the strategies that are necessary. In order to reach a consensus, they need documented, objective information developed by unbiased, independent sources. While this may be an idealistic, even naïve, objective, it is also an imperative one. Figure 1 shows a framework that proposes the relationships among the principal

stakeholders and their information source. The information source would be a task force composed of representatives from each of the stakeholder groups, and staffed from academic and research institutions. They would receive information from stakeholders and other sources, analyze it, develop a consensus position and issue reports containing their findings and recommendations. With added information, each of the stakeholder groups would be more likely to collaborate with each other in developing goals, strategies and measurements designed to invigorate a global sustainability movement.

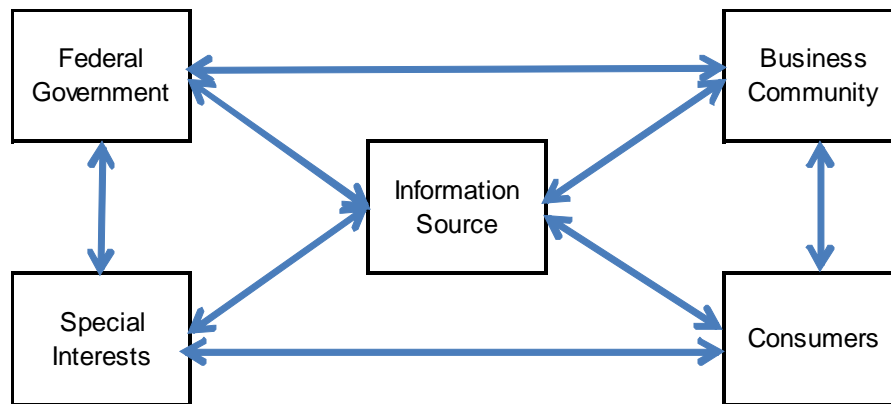


Figure 1. Sustainability Collaboration Framework

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FACTORS RELATED TO THE SUCCESS OF ENTREPRENEURS IN CHINA

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ABSTRACT

Many studies have examined factors related to the success of entrepreneurs in Western countries but little is known about the entrepreneurs running privately-owned businesses in China (Busenitz and Lau, 2001; Cooke, 2008). Both privatization and venture creation have contributed to rapid and sustained growth in China. In this study, we investigate the relationship between the financial performance of the company and factors related to the entrepreneur who founded the company.

Busenitz and Lau (2001) studied the growth *intentions* of Chinese entrepreneurs. We extend their research by looking at *actual* sales growth, as well other measures of financial performance such as ROI and market reputation. We also investigate numerous entrepreneurial factors as suggested in the entrepreneurship literature. Yueh (2009) found that motivation, drive, attitude toward risk, and involvement in social networks differ for entrepreneurs and non-entrepreneurs. Djankov, Yingyi, Roland, and Zhuravskaya (2006) found that entrepreneurial factors generally fall into one of three categories: individual, institutional, or sociological. Yang and Li (2008) classify entrepreneur-related research studies into three types: individual/micro, firm-level, and environmental/macro.

Similar to the research frameworks mentioned above, we divide entrepreneurial factors into a number of categories: individual/founder, board composition/family ownership, firm/company characteristics, and market/environmental. We add a board/family influence category because of the prevalence of family-owned firms in China. Additionally, studies in Western countries have found a link between financial performance and board composition (Changqing and Jianqing, 2004; Corbetta and Salvato, 2004; Daily and Dalton, 1993).

Because of China's rapid and large-scale economic transformation over the past three decades, characteristics of successful entrepreneurs can be very different from those Western economies (Yueh, 2008). Early research on Chinese entrepreneurs has focused on distinguishing entrepreneurs and non-entrepreneurs but, as Yueh notes, it is important

to understand why some privately-owned companies in China perform better than others. Our study contributes to this research need by investigating many potential factors that may be associated with the success of Chinese entrepreneurs and their privately-owned businesses.

The survey instrument has been developed and administered. The survey consisted of 55 multi-part items on 12 pages. The survey was developed in English, translated in Chinese, and later back-translated into English. Survey respondents were the founders of privately-owned companies in either the Yangtze River or Pearl River Delta regions of China. Surveys were sent via postal mail to a randomly selected sample of about 4500 Chinese privately-owned businesses. Follow-up phone calls were made to encourage participation and numerous company founders were surveyed in person by graduate students. We obtained 902 usable responses, for a response rate of 20%. Survey respondents were told that the objective of the study was to provide both a theoretical foundation and decision-making support for private Chinese businesses to attain sustainable development and internationalization.

Survey results are currently being analyzed. Detailed results of the statistical analyses will be presented at the conference.

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TRIALS AND TRIBULATIONS IN SMALL BUSINESS OWNERSHIP

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ABSTRACT

This study examines several potential common problems facing small businesses and the degree to which small businesses associated with a Small Business Technology Development Center identify these as a problem that they encounter. In addition, these common problems are compared between minority and Caucasian businesses owners and between male and female business owners. The sample consists of 237 small businesses owners associated with the North Carolina Small Businesses Technology Development Center. The results indicate finance, marketing, and competitive advantage as the primary areas of concern. Women, however, are more concerned with strategic goal development than their male counterparts and minority businesses owners are more concerned with finance, accounting, personnel, management, and purchasing than their Caucasian counterparts.

INTRODUCTION

Entrepreneurship has long been considered a powerful source of economic growth and innovation (Reynolds & White, 1997); as such each and every one of us has a vested interest in promoting the success of small business enterprise in the U.S. Thus, small business and entrepreneurship study continues to be of high importance for researchers in the field. Much of the previous examination of small business has focused on areas such as performance and organizational development, but there remains a continual need to study the underlying problems facing small businesses in order to find effective solutions to reduce these constraints. The purpose of this paper is to examine the self-reported problems of small business owners from a state within the southeast, and consider differences based upon both the gender and minority status of the business owners.

LITERATURE REVIEW

Small businesses play a prominent role in the national economy by providing job growth, technological innovation, economic diversity, increased local spending, and greater regional loyalty (Luke, Ventriss, Reed & Reed, 1988). According to the Small Business Administration (SBA) Office of Advocacy, more than 99% of all current employers are classified as small businesses, and they employ 51% of private-sector workers (SBA Office of Advocacy, May 2002). The Office of Advocacy also estimates that approximately two-thirds to three-quarters of new jobs are expected to come from small businesses.

While the growth in small business ownership is encouraging, owners are faced with many obstacles that limit long-term survival. According to the Small Business Administration, approximately 66% of small businesses survive their first two years. However, the survival rate

drops to only 39.5% after six years of operation, and to less than 20% after 10 years of operation (SBA Office of Advocacy, May 2002).

Gender and Small Business Ownership

According to the GEM's 2006 *Report on Women and Entrepreneurship* (Allen, Langowitz & Minniti, 2007) men are twice as likely to engage in entrepreneurial activities as women on a global scale, indicating the existence of a real gender gap. Similarly, past research has suggested that women are faced with greater obstacles when starting and running a small business.

Some of the specific challenges women may face as they pursue business ownership include access to fewer resources and role models (Hisrich & Brush, 1987; Carter, 2000, Thomas, 2001; Marlow & Patton, 2005), as well as less managerial experience and technical expertise (Chaganti & Parasuraman, 1996; Jones & Tullous, 2002). In addition, women often have less of a credit history (Shaw, Carter & Brierton, 2001), often causing them greater difficulty in obtaining loans (Verheul & Thurik, 2001; Coleman, 2002). Research has also indicated that women may be less interested in business ownership (Matthews & Moser, 1995; Kourilsky & Walstad, 1997) and have less self efficacy for entrepreneurship (Chen, Greene & Crick, 1998). Unfortunately, these factors can cause women to not be taken as seriously and afforded the same level of respect as their male counterparts (Woldie & Adersua, 2004).

While any of these aforementioned factors may impede their progress in achieving entrepreneurial success, entrepreneurship can be an important source of future employment for women. If women are able to overcome these obstacles and start their business, women business owners have an average income level that is 2.5 times higher than women who do not own their business (Daniel, 2004). They do, however, have to overcome many problems to get to this point. Thus, one aspect of the current study is to examine the self-reported problems of current small business owners based upon their gender.

Small Business Ownership for Minorities

Estimates indicate that there exists approximately one million African American owned businesses in the U.S., which account for over \$100 billion in annual sales (African American Entrepreneurs, 2009). In addition, African Americans are 50% more likely than whites to start their own businesses, and 86% of African American teens polled by Junior Achievement expressed interest in starting a business (African American Entrepreneurs, 2009). As suggested by Acs, Tarpley and Phillips (1998), a primary contribution of entrepreneurial ventures is to allow minorities to enter the economic and social mainstream of American society. Similarly, past research has argued that the health and growth of African American-owned small businesses often serves as a strong barometer for the overall progress made by minorities in the U.S. (Feldman, Koberg & Dean, 1991; Thompson, 1999). As a result of the governmental and educational initiatives, the number of opportunities for African Americans to receive training and education for small business development has substantially increased over the last three decades. Recent evidence seems to indicate that minority entrepreneurship has steadily increased during

the past decade, with estimations that currently 30% of small businesses in the U.S. are owned by women or minorities (Bergman, 2006). Furthermore, numerous GEM reports extol the importance of involving minorities in the entrepreneurial process as it can play an important role in accelerating the overall pace of entrepreneurial activity within an economy (Reynolds, Camp, Bygrave, Autio, & Hay, 2001).

While African Americans are disproportionately underrepresented as small business owners in the U.S., the growth rate of African American-owned small businesses is quite high (Martin et al., 2006). In addition, Sriram, Mersha and Herron (2007) suggest that entrepreneurial opportunities are critically important within the African America community as a means of overcoming the stagnation in our national economy, particularly in urban areas.

According to Fairlie & Robb (2008) much is still unknown about why some racial groups are more successful in their entrepreneurial endeavors than others; as such this paper also examines the business problems that are currently faced by African Americans and other minority business owners.

The following research questions were used to increase our understanding of any differences in the problems experienced by small business owners as a result of gender or ethnicity:

Research Question 1: What are the common problems encountered by businesses associated with the North Carolina Small Business Technology Development Center?

Research Question 2: Are the types of problems or degree of problems experienced different based upon the business owner's gender?

Research Question 3: Are the types of problems or degree of problems experienced different based upon the business owner's ethnicity?

METHOD

Participants

Small business owners identified by their membership with the North Carolina Small Business and Technology Development Center (SBTDC) were contacted via email and asked to complete an anonymous online survey regarding their small business and its developmental needs. Special effort was made to reach out to minority small business owners; these individuals received additional reminders to complete the survey. A total of 270 responses were received (18% response rate) of which approximately 237 were usable (others were incomplete). This sample was 55% male and 50% ethnic minority (non Caucasian). The average age of respondents was 49 years and the average length of time that individuals had been in business was 10.7 years.

Measures

As part of the survey, participants provided demographic information, including gender, age, and ethnicity. Of the 50% of the sample that self-identified as being non-Caucasian, 86% reported

being African American. Given the small representation of other ethnic minority groups, ethnicity was dichotomized for purposes of this study into Caucasian and Non-Caucasian groups.

Participants were also asked to indicate to what degree each of several statements was representative of a problem for their businesses. These items were measured using a variation of Davis, Miles and McDowell's (2008) questions on strategic orientation. This twelve item, five point Likert scale ranged from "not problematic" to "very problematic" and was found to have good internal reliability (twelve items, $\alpha = .859$). The items and associated descriptive statistics are shown in Table 1.

Table 1. Small Business Problems

Items	Mean	SD
The following items are representative of common problems encountered by many business owners. Please indicate to what degree each of these is a problem for you.		
Finance	2.97	1.37
Accounting	2.32	1.16
Personnel	2.07	1.11
Management	1.95	1.01
Marketing	2.71	1.23
Operations/Productions	2.16	1.08
Inventory Control	1.70	1.03
Purchasing	1.87	1.13
Product/Market Mix	2.09	1.11
Strategic Goal Development	2.32	1.11
Strategic Goal Implementation	2.40	1.12
Competitive Advantage	2.60	1.19

RESULTS

Table 2 contains the results of the ANOVA comparing the means of male and female small business owners as it relates to common business problems. As can be seen, only one problem is experienced significantly differently for the two – strategic goal development.

Table 3 contains the results of the ANOVA comparing the means of minority and Caucasian small business owners as it relates to common business problems. As can be seen, several significant differences were manifest.

DISCUSSION

Overall, it is not surprising that finance and marketing are two areas of concern for small business owners. These issues have been documented in prior literature and are critical functions to ensure business development and growth (Chrisman & Leslie, 1989; Harris, Grubb & Herbert, 2005). Small business owners are often hesitant to make changes in the internal areas of their business, waiting until the later stages of growth to make the necessary adjustments to the internal operations (Dodge & Robbins, 1992). However, these very issues often impede small ventures from developing the necessary structure to achieve maturity. As suggested by Wu and Young (2002), a successful business venture requires that owners develop a versatile array of skills in the startup phase in order to have a better understanding of potential risks and problems as the business grows and matures.

Table 2. Gender ANOVA

Items		Means	F	Sig
Finance	Males	2.91	.371	.543
	Females	3.03		
Accounting	Males	2.24	.557	.456
	Females	2.37		
Personnel	Males	2.02	.099	.754
	Females	2.07		
Management	Males	1.84	1.675	.197
	Females	2.02		
Marketing	Males	2.69	.011	.916
	Females	2.70		
Operations/Productions	Males	1.84	.078	.780
	Females	2.02		
Inventory Control	Males	2.69	1.776	.184
	Females	2.70		
Purchasing	Males	1.75	2.379	.125
	Females	2.00		
Product/Market Mix	Males	1.94	2.714	.101
	Females	2.21		
Strategic Goal Development	Males	2.10	9.351	.003
	Females	2.58		
Strategic Goal Implementation	Males	2.31	1.382	.241
	Females	2.51		
Competitive Advantage	Males	2.48	1.956	.164
	Females	2.72		

Table 3. Ethnicity ANOVA

Items		Means	F	Sig
Finance	Caucasian	2.82	4.131	.043
	Minority	3.21		
Accounting	Caucasian	2.17	5.063	.026
	Minority	2.54		
Personnel	Caucasian	1.92	5.101	.025
	Minority	2.28		
Management	Caucasian	1.75	12.300	.001
	Minority	2.25		
Marketing	Caucasian	2.68	.103	.749
	Minority	2.74		
Operations/Productions	Caucasian	2.04	3.419	.066
	Minority	2.33		
Inventory Control	Caucasian	1.63	.798	.373
	Minority	1.77		
Purchasing	Caucasian	1.69	7.825	.006
	Minority	2.14		
Product/Market Mix	Caucasian	1.97	2.990	.085
	Minority	2.25		
Strategic Goal Development	Caucasian	2.25	1.117	.292
	Minority	2.42		
Strategic Goal Implementation	Caucasian	2.43	.218	.641
	Minority	2.35		
Competitive Advantage	Caucasian	2.52	1.207	.273
	Minority	2.71		

When we examine the common problems by gender and ethnicity, some interesting trends emerge. Based on our findings, one can conclude that men and women business owners seem to encounter similar problems, with the exception of strategic goal development. This seems consistent with prior research about gender differences in strategic orientation. For example, Verheul, Risseum and Bartelse (2002) found that men are more focused on opportunity recognition, while women are more necessity driven in starting a new business venture. As a result, men tend to focus more on growth strategies while women are more likely to pursue a specialized strategy that focuses on customer service in order to promote continuity rather than expansion.

While men and women share many of the same concerns, a number of differences were found between Caucasian and minority business owners. These findings are interesting in that they are inconsistent with prior research in regards to minority ownership. Some argue that limited opportunities in the corporate world have made entrepreneurship a more attractive alternative for minorities (Basu & Altinay, 2002; Sriram, Mersha & Herron, 2007). However, other research has shown that resource constraints seriously limited the ability of African Americans to successfully start new business ventures (Inman, 1999). As suggested by Smith-Hunter and Boyd (2004), while women generally face a difficult time starting a business, minority women are often the most disadvantaged when it comes to entrepreneurship. One reason that limits the success of African American business owners is they often operate in a racially segregated environment where they are highly dependent on minority customers for survival (Sriram, Mersha & Herron, 2007). In addition, these entrepreneurs often concentrate in the retail and service sectors and are generally located in areas that are plagued by serious financial constraints and socio-economic concerns. The inability to penetrate the more traditional markets often forces minorities to be involved in micro enterprises in industries with higher failure rates (Sriram, Mersha & Herron, 2007).

Although the findings of this study do not help explain any real or perceived performance differences of minority small business owners, it does help us better understand their needs. According to Fairlie & Robb (2008), much is still unknown about why some ethnic groups are more successful in their entrepreneurial endeavors than others; our examination helps shed some light on the types of problems encountered by minority business owners.

Interestingly, research has shown that ethnic business owners often fail to seek out help and advice from mainstream institutions and they tend to avoid business support agencies (Dyer & Ross, 2007). Other studies (Oc & Tiesdell, 1999; Ram, Sanghera, Abbas & Barlow, 2000; Young, 2002) have also found that minority business owners are reluctant to utilize formal training programs. If Kourilsky and Walstad (1998) are correct and skill deficiencies stop minorities from considering business ownership, then the resulting effect can be a limited supply of positive role models for the next generation of entrepreneurs.

Sriram, Mersha and Herron (2007) suggest that entrepreneurial opportunities are critically important within the minority community as a means of overcoming the stagnation in our national economy. A better understanding of the types of problems allows business counselors to offer more effective assistance that can have a direct impact on the success of minority clients (Rice & Matthews, 1995; Wu & Young, 2002). As noted by Greenfield (1987) and Rue and Ibrahim (1998), many new small business owners are very competent in their chosen profession, but lack the managerial or technical skills necessary for strategic planning. Small business owners that engage in more formalized planning typically provide a clearer direction for the business and improve their decision making ability, which can lead to higher growth rates (Rue & Ibrahim, 1998).

Furthermore, in a prior study on business counseling, Chrisman and Leslie (1989) suggested that clients should rely primarily on small business assistance programs for help with administrative and operating problems. They concluded that these programs are better able to provide assistance that allows business owners to reduce their costs rather than help with strategic issues

such as business planning or market analysis. The results from Chrisman and Leslie point out the difficulty in serving the needs of a diverse target audience. One possible alternative is for small business assistance program to develop a more coordinated process in which the various programs specialize in certain areas. The good news is that well designed small business assistant programs have been shown to help improve entrepreneurial attitudes and skills (Robinson, 1982; Mitra & Matlay, 2004).

FUTURE RESEARCH

It may be of interest to further explore the impact that these common problems have on businesses that are currently not associated with a Small Business Technology Development Center. While these firms that were surveyed do offer a mix of businesses from many various industries, others that have no association may encounter similar or different problems. A comparison study could look at the differences between these two distinct groups.

In addition, an examination of these problems at different stages of the businesses life may result in different problems being more or less important as the business and the business owners alike mature. As an example, Management was not an overall area of concern for the sample as a whole, but there was a statistically significant difference between Caucasian and minority owners. Much of the research mentioned earlier indicates that the barriers to entry for minority owners continues to be diminished, but this has been a process over time. This gives rise to the question concerning the age of the respective businesses and how Caucasian businesses may be at a maturity advantage because of a longer lifespan than the minority owners.

Another area of interest includes examining the respective industries that these businesses are currently involved in. Both women and minorities face more difficulty than their male Caucasian counterparts in securing financing and resources and are therefore more likely to enter industry sectors and businesses that require less start-up capital such as manufacturing or production. Thus, these differences may result in differences concerning the common problems that women and minorities face in their business operations.

Conclusion

Research has shown that there are many different problems encountered by small businesses, business owners and managers. This study has taken steps to examine these common problems and the degree to which small businesses encounter them. While we found that financing, marketing and competitive advantage are some of the primary concerns, it is interesting to note that there are statistically significant differences when examining these problems in light of gender and ethnicity. These include findings such as women find strategic goal development more of a problem than men, and that minorities find finance, accounting, personnel, management, and purchasing more of a problem than their Caucasian counterparts. Researchers must continue to examine these problems and how these problems can be mitigated. Overall, great strides have been made to create a more level playing field for entrepreneurs entering business, but there is still room for improvement.

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CHARACTERISTICS OF STRATEGIC PLANNING IN SMALL EXPORTING FIRMS

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ABSTRACT

There is widespread recognition in the U.S. of the importance of international trade and the crucial role of small firms in promoting exports and reducing the trade deficit. However, there is surprisingly very little empirical work examining the techniques, tools, and approaches to planning that are actually being used by small companies.

This study is designed to partially fill this gap in the literature by reporting the results of a survey of 838 small firms. It seeks to compare exporters and non-exporters with respect to their planning tools and techniques. The intent is to develop a profile for small exporting and non-exporting firms with respect to their strategic planning processes. Some explanations as well as implications and limited generalizations are developed.

INTRODUCTION

International trade is becoming progressively more important to the U.S. economy. In 2009 almost \$1.6 trillion of goods and services were exported. Between 1998 and 2004 they accounted for approximately half of the nonagricultural gross domestic product (GNP) (U.S. International Trade Commission, 2010). Increased exports give rise to increased employment levels and economic growth. It is estimated that \$1 billion in exports translates into 19,000 jobs for U.S. workers and that export growth is responsible for approximately one-third of all GDP growth. In 2006, nonfarm exporters employed 60 million workers compared to 34.6 million in 1993 (U.S. International Trade Commission, 2010).

Small manufacturing firms accounted for 30% of total merchandise exports between 1997 and 2007 (U.S. International Trade Commission, 2010). Between 2001 and 2008 the number of small manufacturing firms reporting that exports comprised more than ¼ of sales grew from 3.8% to 12.8% (Facts of Manufacturing, 2009). Small firms were responsible for creation of 64.1% of net new jobs between 1992 and 2006 (U.S. International Trade Commission, 2010). Manufacturing firms that export tend to pay their workers more than the average wage (Bernard, et. al., 2007). There are two reasons for the higher wages. First, exported goods tend to be higher-valued products and are produced by highly skilled workers. Second, foreign competition compels exporting companies to be more competitive (Facts about U.S. Manufacturing, 2006; U.S. Small Business Administration, 2006).

Industrial production in the U.S. relies substantially on small companies. Their importance is highlighted by the fact that they comprise 97% of all exporters and are responsible for 39 percent of total exports (Facts about U.S. Manufacturing, 2006). Taken as a whole, small firms play an increasingly crucial role in the U.S. economy. They represent more than 99 percent of all employers, are responsible for about one-half of the GDP, and generate more than one-half of all sales. They employ more than one-half of the work force and 38 percent of

workers in high-tech jobs. While many large companies continue to downsize, virtually all new jobs are created by small businesses (U.S. Small Business Administration, 2000; U.S. Department of Commerce, 2005).

Although continued export expansion is expected in the foreseeable future, the U.S. continues to experience deficits in its balance of trade. In 2009, the global merchandise deficit was \$378 billion and net trade had been in deficit for more than 29 years. The shortfall in manufactured goods seems to be accelerating – the global share of U.S. manufactured exports declined from 19% in 2000 to just 14% in 2007. (Facts about U.S. Manufacturing, 2009). During this same time period, China's share rose from 7% to 17%.

These facts have provoked a growing amount of research. A substantial literature has addressed the activities and effectiveness of firms involved in international business. One activity which has received particular attention from researchers, business practitioners, and policy makers is exporting. Most of these efforts have centered on large companies based on the assumption that international involvement is the domain of large corporations that possess special skills and considerable resources (Liesch & Knight, 1999; Ogbuehi & Longfellow, 1994). However, there is a growing realization that a major weakness of many such studies is their "global" nature, i.e., treating all firms alike, despite the presence of meaningful differences among them in terms of their size. Consequently, a number of writers have recognized the value of segmenting exporting firms on the basis of size (Samiee & Walters, 1990; Palmetto Consulting, 2004). For example, researchers found that firm size correlates highly with export behavior (Naidu & Prasad, 1994), type of entry into foreign markets (Cavusgil & Kirpalani, 1993), strategic orientation toward exporting (McKee et al., 1989), and international marketing effectiveness (Kirpalani & Macintosh, 1980). Pope (2002) concluded that, among exporters, smaller companies tend to have unique products and possess technological advantages over competitors. Recent research suggests that small businesses with more than 20 employees "appear to be taking advantage of export opportunities at or above expected rates" (Mittelstaedt et al., 2003: 81).

REVIEW OF THE LITERATURE

Four streams of research have examined export behavior from the perspective of small businesses. One stream has focused on unique firm advantages which facilitate initial and continued involvement in exporting. They include competitive pricing, very sophisticated products, and the expertise to manufacture technically superior or highly differentiated products. This line of inquiry has also found that making use of state sponsorship of foreign trade offices in target markets and attention to both before and after sales service help to increase success in exporting (see, e.g., Edmunds & Khoury, 1986; Cavusgil, 1984; Reid, 1983; Wilkinson, 2006).

A separate line of research has been devoted to examining decision-maker characteristics such as their education, foreign language skills, external contacts, and "international orientation". For example, Reid (1981) found that certain variables such as educational background and knowledge of foreign languages serve as antecedents of attitudes toward export activity. A related topic concerns the training and development needs of owners/managers. In her study of Canadian small businesses, Carrier (1999) reported that managers expressed their need for training in export financing, international marketing, and the processes (logistics, transportation, customs, and legal aspects) of international trade. Others have examined the relationship between export activity and top executives' risk propensity and their expectations regarding

specific objectives such as profits and growth (Bilkey, 1982; Czinkota & Ursic, 1983; Ogbuehi & Longfellow, 1994). Still others have focused on the decision makers' perceptions of barriers to exporting. Yaprak (1985) found that non-exporters perceive three major barriers to export involvement (insufficient information about foreign markets, lack of foreign contacts, and scarcity of competent personnel), while problems encountered by exporters are related to external and market variables such as transportation difficulties, red tape, and slow payment by foreign buyers.

The third stream of research has dealt with the extent to which resources are devoted to exporting. The willingness of top executives to allocate the necessary resources for this activity has been found to be a critical factor. These resources include: hiring and training a skilled staff, collecting information about foreign markets, visiting other countries to assess their markets' potential, developing policies toward exporting, and learning about exporting requirements such as documentation and financing (Bilkey, 1982; Czinkota & Ursic, 1983; Buatsi, 1986).

Finally, some authors have focused on classifying exporting companies based on their level of internationalization (Gankema et al., 2000). The number of levels identified differs widely, depending upon the degree of aggregation employed. The principal conclusion of these studies is that a firm's level of internationalization has a major impact on its particular needs, policies, and practices.

Importance of Planning for Small Firms

Research interest in planning began in earnest in the late 1960s. While a large body of this literature has concentrated on large firms, in recent years some research attention has been devoted to small companies. Some have examined the differences between formalized and non-formalized plans and developed various schemes for classifying small businesses based on the thoroughness or sophistication of the planning process (Rhyne, 1987; Bracker & Pearson, 1986). For example, Hahn and Powers (1999) operationalized the construct "planning sophistication" by using the five steps to the strategic planning process: defining a firm's mission; performing an environmental scan and analysis; establishing objectives, strategies, and tactics; implementing; and conducting a performance review and making the necessary adjustments.

In a related area, Rue and Ibrahim (1996) studied the planning tools and techniques used by small businesses. They surveyed small firms to determine whether they develop written plans; the duration of these plans; the external factors they consider when plans are developed; the objectives they set; the pro forma financial statements they develop; whether computers or consultants are used in the process; and how frequently company performance is evaluated. Although the study provided interesting insights, it focused on family-owned businesses - typically a subset of small firms - and the sample included both exporters and non-exporters.

Others have addressed the link between planning and performance. They contend that good planning is a key to the firm's success and is a major contributor to profitability. For example, a survey of small firms revealed that 94 percent of those that performed strategic planning reported improved performance (Baker et al., 1993). Another study compared small firms with structured planning processes with those whose planning is unstructured and found that the former had plans that are more thorough and accurate, and their performance is significantly higher (Lyles et al., 1993). Finally, a meta-analysis by Schwenk and Shrader (1993) of fourteen studies found a strong relationship between long-range planning and small company performance.

Finally, some attention has been given to whether small firms focus on operational, as opposed to strategic, planning. A number of researchers have shown that small businesses tend to place great emphasis on operational planning (Shrader et al., 1989). Indeed, some writers

have argued that small companies should not attempt to use planning techniques found in larger businesses and that the usage of these techniques could be one of the reasons behind the failure of many small businesses (Scarborough & Zimmerer, 1987). Other studies strongly suggest that simply engaging in a long-term planning process is beneficial to small firms as it leads to an improved understanding of the business (Lyles et al., 1993). The adoption of a long-term perspective has intuitive appeal. Many small companies are less constrained by the need of professional managers to focus on short-term performance targets, and therefore are apt to adopt a more rational approach to long-term planning. Whereas these managers are inclined to maximize personal benefits over their expected period of employment, time-horizons of small firms' owners tend to extend over a lifetime or across generations.

PURPOSES OF THE STUDY

Despite these research efforts and the growing importance of exporting in the U.S. economy there is surprisingly little empirical work that has examined the techniques, tools, and approaches to planning that are actually being used by small exporting firms. This study is designed to partially fill this gap. It continues in the tradition of the research stream that attempts to uncover meaningful distinctions among firms, which often are unseen when companies are combined into one large group.

Specifically, it seeks to characterize small exporting firms in the following areas: (1) whether these companies develop any written plans, (2) the external factors that serve as inputs to the plans, (3) the types of objectives that are formulated, (4) how those who follow a growth strategy intend to achieve it, (5) the types of financial planning undertaken by these companies, (6) whether outside consultants or computers are used to assist in the planning process, and (7) how frequently overall performance is reviewed to detect differences between planned and actual performance. The intent is to develop a profile for small exporting firms with respect to their strategic planning processes.

METHODOLOGY

Sample

The sampling frame consisted of firms listed in the *North Carolina Manufacturers' Directory*, the *Georgia Manufacturing Directory*, and the *South Carolina Industrial Directory*. Only non-affiliated, autonomous companies were included in the sampling procedure. Consistent with previous writing on the subject, the sample was restricted to a particular region since firms within the same region execute their activities under similar influence from environmental conditions and complexity (Wolff & Pett, 2000). Also, the analysis focused on one industry, thus ensuring greater homogeneity among the companies. This addresses a concern expressed by Westhead and Cowling (1998) who argued that most small business research is characterized by a failure to control for differences based on the main industrial activity for the companies under study.

In the three states represented in the sample, exporter's share of the gross domestic product in 2009 was \$23.9 billion (2.3%) in Georgia, \$21.8 billion (2.1%) in North Carolina, and \$16.5 billion (1.6%) in South Carolina. A total of 1050 small business exporters were randomly selected. Data collection was conducted via a mail questionnaire of the owners or top executives. Prior to mailing the questionnaire, telephone calls were made to ascertain that these companies were still in business, verify whether they were exporters or not, confirm the name

and title of the key top executive, and notify them that they will be receiving a questionnaire within a few days and apprise them of the purpose and importance of the survey. Although there is no universally accepted criterion for delineating small firms, the number of employees was selected as the key indicator of firm size (Wolff & Pett, 2000). In this study the definition of “small firm” follows the U.S. Small Business Administration classification. That is, firms that employ fewer than 500 employees were selected.

Each respondent was sent a copy of the research instrument accompanied with a letter explaining the project and assuring them of the confidentiality of their answers. A first mailing and one telephone follow-up urging participants to complete and return the questionnaire generated 420 completed and usable responses.

Measures

Respondents were asked to indicate their present position with the company (e.g., CEO, President), in what year the company was founded, the number of full-time employees, the type of ownership of the business, and who founded the company. In addition, they were requested to indicate whether their firm prepares a written plan and, if so, the time period it covers.

Following the convention used in previous research (Rue & Ibrahim 1996), those with written plans were asked whether they attempt to identify and analyze any of the following external factors: population/demographic trends, national political developments and trends, international political developments and trends, personal family incomes, social/cultural trends, non-product technological breakthroughs, labor-management relations, and national and international economic developments and trends. They were then asked if their plan includes quantified objectives for any of the following: sales, earnings, return on investment, capital growth, market share, sales/earnings ratio, and international expansion. Those with a growth strategy were asked whether they develop plans and budgets for any of the following: hiring and training of key management personnel, plant expansion, new product development, managerial succession, corporate acquisition, equipment acquisition, research and development, advertising, and expansion of international markets. Additional items requested information on the types of pro forma statements which are developed; whether outside consultants assist in formulating these plans; whether computers are employed in the planning process; and how frequently performance is evaluated and whether, as a result, the plans are reviewed and revised.

RESULTS

The title of President was held by 298 of the respondents, 240 were CEO's, and 230 chaired their respective boards of directors. Seventy-seven percent were private companies and 87 percent were founded by the respondents or their parent(s). The median number of employees was 35, and the median age of the firms was 31.

The great majority of the firms in the sample (91.9%) do prepare some type of written plan. Table 1 presents the time period they cover. Almost 77 percent prepare plans extending three or more years into the future. Thus much of the planning that is being undertaken appears to be long-range as opposed to operational.

Written Plans

Table 1: Time Period Covered in Long-Range Plans ^a

Time Period	Total (<i>n</i>=420)
One year	20 (4.8)
Two years	44 (10.5)
Three years	112 (26.7)
Four years	87 (20.7)
Five years	103 (24.5)
Over 5 years	20 (4.8)
No written plans	34 (8.1)

^a Column percentages are in parentheses.

Planning Techniques

Consistent with the Rue and Ibrahim (1996) study, this survey specifically sought information concerning how the respondents approached the following general areas.

Premises

Table 2: Premises Contained in Written Plans ^a

Premise	Total (<i>n</i> = 386)
Population/demographic trends	75 (19.4)
National political developments	181 (46.9)
International political development	130 (33.7)
Personal family incomes	72 (18.7)
Social/cultural trends	77 (19.9)
Non-product technological breakthroughs	39 (10.1)
Labor-management relations	75 (19.4)
National economic trends	244 (63.2)
International economic trends	227 (58.8)
No premises identified	16 (4.1)

^a Column percentages are in parentheses.

Because of the potential impact of external forces on a company's future, it is essential that the plan address some of these factors. Premising refers to the consideration of forces outside of the immediate operating environment of the firm. Generally, they are beyond its control. Environmental scanning is the means by which managers can perceive and cope with

external events and trends (Miller & Toulouse, 1998). More than two decades ago, it was noted that environmental scanning had become a widely accepted part of the strategic planning process of many U.S. companies (Jain, 1984) and that the effectiveness of strategic planning is strongly influenced by the ability to do so (Specht, 1987). Researchers report that such activities contribute significantly to firm performance (Preble et al., 1988; Venkatraman & Prescott 1990). As shown in Table 2, only 4.1 percent of exporters do not attempt to identify any premises. The most frequently used relate to national economic and political developments and trends. This is probably due to the availability and accessibility of related information.

Objectives

Planning can only be a useful managerial function if objectives are properly chosen. Without concrete objectives, the entire planning activity can easily turn into a futile exercise. Objectives provide benchmarks for evaluating progress and represent a managerial commitment to achieving certain results. Companies whose managers set objectives typically outperform those that do not (Thompson & Strickland, 2003). Many firms today are striving to attain multiple objectives as opposed to a single one. When choosing multiple objectives, the strategist must be careful to ensure that the different objectives are compatible. Managers must set objectives so that they are specific and practical; they should challenge the company but must be attainable. Whenever possible, quantified objectives are desirable.

The great majority of those with written plans establish quantified objectives. Table 3 shows that sales are assigned the highest priority, probably because they are foremost in the minds of the managers. Indeed, this measure was specified by every company that prepares quantified objectives. Virtually all of the respondents intend to expand international activities. This suggests that the preponderance of exporters are interested in pursuing a growth strategy at least with regard to exports. Among those who reported setting objectives, all but 37 had more than one measure.

Table 3: Objectives Stipulated in Written Plans ^a

Objective	Total (<i>n</i> = 386)
Sales	338 (87.6)
Earnings	92 (23.8)
Return on investment	95 (24.6)
Capital growth	131 (33.9)
Market share	132 (34.2)
Sales/earnings ratio	58 (15.0)
International expansion	330 (85.5)
No objectives are established	48 (12.4)

^a Column percentages are in parentheses.

Growth

Eighty-six percent of respondents indicated that they pursue a growth strategy. In today's world, many executives view growth as the best path to survival and higher earnings. This is a very seductive strategy; it is exciting and ego-enhancing and is viewed as an indication of success. This strategy is especially important to the survival of small exporting firms in today's global market. They must formulate and implement growth strategies to avoid decline and enhance their ability to remain competitive (Poza; 1989). On the other hand, growth, if rapid, can be difficult to sustain.

Table 4: Approaches for Implementing Growth Strategies ^a

Area	Total (n = 332)
Hiring and training of key management personnel	110 (33.1)
Plant expansion	121 (36.4)
New product development	80 (24.1)
Managerial succession	32 (9.6)
Corporate acquisitions	44 (13.3)
Equipment acquisitions	164 (49.4)
Research and development	77 (23.2)
Advertising	171 (51.5)
Expanding international markets	270 (81.4)
No plans	65 (19.6)

^a Column percentages are in parentheses.

As shown in Table 4, approximately one-half of the companies prepare plans and budgets for advertising and equipment acquisitions. Of all the factors listed in this section, these areas are probably the easiest to predict. It is interesting that corporate acquisitions are considered by only 13.3 percent of the businesses. Although they are difficult to forecast, it has been shown that those who grow through acquisitions generally outperform those that do so through internal means (Sharma, 1998). Finally, succession plans are developed by less than ten percent of these companies. Among those who reported that their strategy is one of growth, almost 20 percent failed to develop any specific plans and budgets to carry out this strategy.

Planning Tools

Financial Analyses

One of the dangers associated with growth stems from the financial mechanisms which are involved in the growth process. The problems caused by the interaction of cash flow and growth have perplexed managers for years. Managers realize that they must maintain a reserve of cash (or other readily convertible current assets) which is adequate to meet expenses as they fall due. Their dilemma is a balancing process that requires accurate forecasts. Once the forecasts

for future expenditures (and perhaps growth) are predicted, they must be evaluated to determine if they are financially sound. At the same time, enterprising managers desire to utilize the company's financial resources to provide for growth and the generation of greater profits. They understand that leverage (debt) can be used to balance the risk between the owners and creditors and is a valuable tool when a project yields a higher rate of return than the cost of capital.

Table 5: Pro Forma Financial Statements Used in Planning ^a

Financial Statement	Total (n = 383)
Balance Sheet	222 (58.0)
Cash Flow Analysis	256 (66.8)
Income Statement	298 (77.8)
None	76 (19.8)

^a Column percentages are in parentheses.

Although the financial aspects of business planning can be quite complex, they should culminate in the preparation of pro forma statements. Respondents were asked if they prepared pro forma balance sheets, income statements, and cash flows as an integral part of their plan. Three companies did not respond to this question. Table 5 shows that a large majority prepare pro forma financial statements. The concern for profit is reflected in the fact that more firms prepare a pro forma income statement than a balance sheet or cash flow analysis.

Outside Consultants

This study sought information as to whether consultants are used to assist in the planning process. Four firms did not respond to this question. Table 6 shows that a large percentage, approximately one-third, do not use the services of consultants in their planning process. This is not surprising since the great majority of smaller businesses are probably reluctant to use outside resources. The data clearly indicate that consulting firms (mostly auditing firms, tax consultants, and international trade specialists) are the single largest source of consultants. They are followed by free lance individuals, primarily business planners, and, finally, contract research firms.

Table 6: The Use of Outside Consultants in Long-Range Planning ^a

Source	Total (n = 382)
Consulting Firms	198 (51.8)
Contract Research Firms	7 (1.8)
Free Lance Individuals	67 (17.5)
None	121 (31.7)

^a Column percentages are in parentheses.

The Use of Mathematical Models and Computers

The increasing proliferation of computers should make more and better information available for planners. Mathematical models can be developed to test alternative courses of action. Many parts of the planning process can be automated, thus allowing the planners more time to develop strategies. Many articles have been written proclaiming the virtues of computers and mathematical models and how they can assist the planner, particularly by reducing uncertainty and supporting decision making (e.g., Georgeoff & Murdick, 1986; Van den Poel & Buckinx, 2005). Although the focus of these studies has been on large firms (Klein & Linneman, 1984), more recent writers have discussed how small businesses can successfully use these tools to assist in planning (e.g., Ahire, 2001). Many techniques are now suitable for small firms because of advances in information technology and the increasing power and declining cost of computers. Fully recognizing the usefulness of these tools, this study sought to determine whether computers or mathematical models are used on a regular basis to assist in developing their written plans. The questionnaire did not inquire as to whether computers are used in areas unrelated to planning.

Among those with written plans, those who use, on a regular basis, a computer or mathematical model to assist in planning comprise 37.8% of respondents. Brief comments describing their use were solicited. The most widely used applications are related to financial and sales forecasting as well as financial control. They assist in making decisions concerning sales, financing, inventory, production, and advertising. The specific techniques include spreadsheets, trend analysis, pro forma models and, in three percent of cases, return on investment simulations.

EVALUATION

Table 7: Frequency of Review and Revision of Long-Range Plans^{a, b}

	Total
Frequency	(<i>n</i> = 381)
Weekly or less	12 (3.1)
Monthly	17 (4.5)
Quarterly	190 (49.9)
Semi-Annually	19 (5.0)
Annually	110 (28.9)
Never	33 (8.7)

^a Column percentages are in parentheses.

^b Total column percentage is not 100 due to rounding.

Because planning is a continuous process, plans should be periodically reviewed and revised. Sharma, Chrisman and Chua (1997) have pointed out that very little is known about how company performance is evaluated in many small firms. Clearly, those charged with responsibility for the plan must determine whether the company's performance and other

activities are compatible with the plan. All too often a sophisticated written plan is developed and never implemented. Because of the uncertainty involved with planning, the plan must be updated as information is gathered and changes take place.

The respondents were asked if their company periodically conducts a formal performance evaluation and if the plans are reviewed and revised as a consequence of this evaluation. Five companies did not respond to this question, and some reported more than one frequency. In these cases, only the most frequent review period was recorded. It is evident from Table 7 that quarterly reviews are the most popular among exporters. Interestingly, 33 (8.7%) exporters did not periodically evaluate overall performance. Approximately 90 percent of the firms that conduct these evaluations indicated that the plans are then reviewed and revised.

DISCUSSION AND CONCLUSION

The purpose of this study was to partially fill a void in the literature by examining the planning practices of small exporting firms in the U.S., a population which has been largely ignored in past research. Because of the growing prominent role of these businesses in the economy, understanding the extent of their planning efforts is a worthwhile research theme. This study focused on a subgroup of these companies – those in the manufacturing industry.

These results are important for several reasons. They indicate that the planning practices of smaller businesses may be more sophisticated than generally perceived. All small exporters indicate objectives for growth in written plans. This finding is consistent with the results reported by previous researchers (Dreux, 1990; Muscettello, 1990). This, in itself, demonstrates that many of today's small exporters have moved beyond day-to-day managing and are planning well into the future. Thus much of the planning appears to be long-range as opposed to operational. One possible explanation for this finding is that, compared to domestic sales, exporting requires more lead time and more “up-front” costs and, therefore, a long-term relationship with buyers. These factors alone necessitate a long-term view and therefore provide the rationale for developing written and long-term plans. An alternative explanation is that the planning process itself and the longer planning horizon facilitate the exploration of additional markets through exporting. Clearly, this study is “correlational”; future studies should examine the nature and direction of this relationship

Another important point is that the great majority of these firms identify at least one external factor that serves as input to their plans. National and international political and economic trends are examined by many of these firms.

All but 48 (87.6%) of those who develop a written plan establish quantified objectives. Adding further encouragement is the fact that many of the plans being prepared by these small exporting businesses contain some fairly sophisticated elements beyond simply setting objectives for sales. For example, slightly greater than one-third set objectives for capital growth and market share, while nearly one-quarter develop objectives for earnings. More than 90 percent reported setting more than one objective. This is supported by previous research on larger firms in several major industries which found that most businesses pursue multiple quantitative objectives (Shetty, 1979; Schneider, 1990).

The preponderance of these businesses pursues a growth strategy and almost 80 percent prepare specific plans to implement it. Eighty percent develop some type of pro forma financial statements, two-thirds seek the services of consultants in their planning process, and one-third use, on a regular basis, a computer to assist in planning. More than 90 percent conduct a

periodic evaluation of their performance to detect differences between planned and actual performance, and revise their plans as a consequence of these evaluations.

On the negative side, only 58% of these firms develop pro forma balance sheets and 67% perform cash flow analyses. Also, a very small proportion develops specific succession plans. This has been one of the most pervasive problems in small companies. In this study almost one-third are actively hiring and training key managers, yet less than 10 percent prepare any type of succession scheme in their written plans. This low percentage is supported by other studies that report the inability or unwillingness of the owners of small enterprises to plan their succession (Marschak, 1993; Seymour, 1993; Welsch, 1993). Current owners tend to view this question as being far away into the future and therefore not pertinent at the present time (Bruce & Picard, 2006). Family members or key employees may be reluctant to delve into this matter because the founders wish to forestall difficult decisions and perceive such discussions as a sign of their mortality (Aronoff & Ward, 1992). Therefore, while this matter is especially critical for these firms, it is not surprising that so few address the problem, given the sensitive and personal nature of this issue. Although much of the research on succession has focused on U.S. firms, many small businesses in other countries face similar predicaments (see, e.g., Power, 2005). However, it is possible that many owners may have addressed this issue and perhaps developed specific succession plans but, fearing conflicts among would-be successors, are reluctant to disclose these plans (Bruce & Picard, 2006).

The results of this study call to attention additional areas of concern. Only one in five companies included population/demographic trends, personal family incomes, social/cultural trends, and labor/management relations in their written premises, while non-product technological breakthroughs are considered by about 10 percent. It is interesting to note that while 86 percent stated that they are pursuing a growth strategy, only 80 percent of these companies develop specific plans and budgets to implement this strategy. Another interesting finding relates to the fact that one third of exporters do not retain any consultants. This is quite surprising given the rapidly changing technological advances and the complexity of laws and regulations affecting business in general and international business in particular. Indeed, there is evidence that many small businesses tend to perceive the consulting services they receive as having a positive impact (Nahavandi & Chesteen, 1988). Another issue concerns plans that extend beyond five years; less than 5 percent have such a long-term horizon. However, all these companies have an exit strategy in mind. Finally, almost two thirds did not utilize a computer to assist in their planning. This high percentage is not surprising since researchers have found that smaller firms do not have the necessary expertise, the financial resources, and the required software and hardware (Peterson, 1996). Therefore, they tend to use subjective and simpler techniques (Smith et al., 1996). However, the importance of these tools will increase with growing business complexity and the necessity to gain and sustain a competitive advantage.

Although this study provides many important insights, the results raise additional research questions that merit further study. For example, to what extent do the planning practices of these businesses differ from those of large firms? Are there differences between exporters and non-exporters with respect to the planning process? Do these planning practices differ from those of family-owned firms? Does a firm's level of internationalization have an impact on its planning practices? Another interesting issue concerns the relationship between planning and performance. Is the performance of exporters categorized as planners different from that of non-planners? Also, future research may need to address the role of the board of directors and its degree of involvement in the planning process. Studies that examined this issue

focused mostly on large firms. Another question that arises from this research pertains to succession plans. Given the importance of this issue, future in-depth studies should provide possible explanations for the absence of such plans in nearly all (90%) of these businesses. Finally, with the presidential goal of doubling exports in the next 5 years, are there differences between exporters and non-exporters?

This study is not without limitations. Future extensions should give thought to replicating it using different populations. For example, firms in other regions of the U.S. should be surveyed. An additional caveat concerns the generalizability of the results. A study such as this one focuses on many firms in one industry, manufacturing, thus ensuring a greater homogeneity among the companies. However, it opens a line of inquiry on whether these results are valid across other industries. Thus another study which is devoted to other industries would be a fruitful endeavor. Another cautionary note concerns the possibility of bias in the data provided by the companies in the sample. Although this cannot be completely ruled out, self-report measures are indispensable in organizational research (Gupta & Beehr, 1982). Indeed, in certain research contexts, self-reports may provide more accurate estimates of population parameters than behavioral measures (Howard et al., 1980). Finally, as mentioned earlier, it cannot be said that these results empirically resolve the causal relationship between the variables. Clearly, this study is "correlational."

In conclusion, with increasing global competition, falling trade barriers, and improved international communication, international markets can be quite attractive to small firms. This study's major findings will hopefully contribute to efforts to focus the attention of researchers, business practitioners, and policy makers on the planning processes and the needs and challenges facing small firms. These companies can be formidable competitive forces both domestically and internationally as they often are nimble and can be the sources of technological innovations. Such findings should accelerate the search for ways to improve the capacity of small firms to remain competitive in the global marketplace.

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STUDENT ATTITUDES ABOUT CORPORATE AMERICA
A Study of Business Students at Historically Black Colleges and Universities

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ABSTRACT

In the wake of recent business missteps and scandals this survey and study looks at business student attitudes toward corporate America and the implications for their ethical behavior upon entering the corporate/business environment after graduation. The focus of this study is students at two Historically Black Colleges and Universities (HBCU). The impact of AACSB Business Ethics Education Requirements will also be considered.

INTRODUCTION

Over the last decade, there have been numerous scandals about major corporations in America. Cases such as Enron, Anderson, WorldCom and numerous others certainly have not gone unnoticed by students. A survey was conducted in the mid-to-late 1990s at an HBCU in the southeast. The study reported on here continues that work with surveys of students at another HBCU. Comparisons will be made contrasting the attitudes of students over time and between the two HBCUs. A brief review of relevant literature points out the importance of this research.

Susan Eisner [2] studied the Impact of High Visibility Corporate Scandal on Business Student Attitude and concluded that Business students appear to support the presentation of the “bad deeds” stories that the media prioritize rather than stories about “good deeds.” Survey results reported in this paper suggest that undergraduate business students aspire toward ethical business behavior, and are open to courses that will help them achieve it. A new study by Oregon State University researchers [3] finds that business school students do not differ from other students in terms of personal moral philosophies – a finding that contradicts some widely held assumptions about business students and business education. Numerous studies have analyzed student attitudes toward business ethics and codes of ethics and reported similar findings. Finally, In Fall 2007, the Aspen Institute Center for Business Education, a program of the Aspen Institute Business and Society Program (Aspen BSP), went out to 15 business schools to survey MBA students about their attitudes towards the relationship between business and society [1]. This is the third time in the last nine years that Aspen BSP has surveyed MBA students to find out what they are learning and thinking about that relationship. What they have discovered through those surveys is that MBA programs definitely influence the way students think about the role of business and its relationship to society once the students become managers and leaders. Each of the surveys was conducted via the Internet by Universum, a global consulting and communications company. A total of 1,943 students

responded to the 2007 survey. This recent survey shows some encouraging changes in the way business school curricula address the complex relationship between social issues and business practices and decisions.

In the study reported in this paper, through the use of a very short questionnaire (shown at the end of this proposal), students are asked to indicate their attitudes about ethical practices in business. The initial surveys in the 1990s were given in Principles of Management Courses where students were either sophomores or juniors. The 2010 survey has been administered in Principles of Management and Organizational Behavior Courses. Data collection began during the 2010 summer session. As the research continues in fall 2010, students in other sophomore and junior-level courses will be asked to complete the survey to increase the pool of responses. Students in Principles of Management and Organizational Behavior courses are typically business management majors and are juniors and seniors. Both courses are junior-level courses. Majors other than management may require students to take one or both courses but the enrollment is usually very small relative to business student enrollment in general. No other information is collected about the respondents. Therefore an analysis will be made of the responses to determine if attitudes of students are similar over a 16 year period. Some effort will be made to survey current Principles of Management students at the HBCU where the survey was initially administered.

As an AACSB-Accredited Institution, an emphasis on ethics has been integrated into most of the courses in our Business Program. Ethics education is called for in the general knowledge and skills portion of the standards for undergraduates and in the management-specific portion of the standards for undergraduate and master's students (See **Standard 15: Management of Curricula**) [4]. Ethics research suggests that student attitudes on business are formed through classroom and personal experiences, through media coverage of business scandals and through observing the behavior of others. Research also concludes that student attitudes about business are indication of the ethical behavior of students both as students and as employees.

A review of the literature revealed no studies of African-American student attitudes about business in general and business ethics specifically. This study will add this perspective to the body of literature.

CONCLUSION

Preliminary results indicate that responses by management majors in 2010 are similar to those in the 1990s. Simple statistical analysis will be conducted once the final survey results have been compiled. These results will be reported at the 2011 SE DSI meeting.

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**RECENT BUSINESS STUDENT ATTITUDES TOWARD BUSINESS
QUESTIONNAIRE**

1. How would you describe your own attitude toward business in this country?
 - a. Very favorable
 - b. Somewhat favorable
 - c. Somewhat unfavorable
 - d. Very unfavorable
 - e. Not sure

2. Federal regulation of business had once been too tough, but now has gone too much the other way and is too lax.
 - a. Agree
 - b. Disagree
 - c. Not sure

3. How would you rate the ethical standards of business executives?
 - a. Excellent
 - b. Pretty good
 - c. Only Fair
 - d. Poor
 - e. Not sure

4. Business has gained too much power over too many aspects of American life.
 - a. Agree
 - b. Disagree
 - c. Not sure

5. Which of the following do you think business would do to obtain greater profits?
(Rank from 1 to 6 (highly probable))
 - a. ____ Deliberately charge inflated prices
 - b. ____ Harm the environment
 - c. ____ Knowingly sell inferior products
 - d. ____ Put its workers' health and safety at risk
 - e. ____ Endanger public health
 - f. ____ Sell unsafe products

Attitudinal Differences Toward Women Managers By Students At Different Stages Of Their Business Education

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A number of studies have historically been done to assess the attitudes of college students toward women in general. The landmark study was done by Epstein and Bronzaft in 1972. They found that first year college students at the time of their study expected to become more career oriented rather than the 'traditional' housewife. Throughout the 1980s, a number of research studies also found support for more positive attitudes toward women in traditionally male-dominated occupations including the presidency of the United States (Cherlin & Walters, 1981). Also, a national survey of first year college students conducted in 1993 (Higher Education Research Institute) found increased support for women to be less involved in traditional roles like child rearing and house-keeping.

Over the years, various factors have been hypothesized as indicators and/or moderators of the attitudes toward women. These include prevailing attitudes in a particular nation and the historic and traditional roles within a

culture. Age cohorts have also been found to influence attitudes toward women's roles in society. Dambrot, Papp, and Whitmore (1984), for example, found that older men and women are more conservative in their attitudes toward women's role in society than their younger counterparts.

Regionalism has also been used as an explanatory factor for the variation in attitudes toward women in the United States. Research studies on a state by state basis for example found that students at the University of Washington in Seattle had more liberal attitudes toward women's role in society than a comparable sample of students from the state of Texas (Lunneborg, 1974; Muehlenhard & Miller, 1988). In general, there are indications by a number of studies that men and women in the Southern part of the United States may have more conservative attitudes toward the roles of women (Hurlbert, 1988). For example, it is more common for men and women from the Southern part of the United States to have more negative attitude toward the employment of married women (Rice & Coates, 1995). Nevertheless, one common theme for research studies that have been done in the United States indicates a more egalitarian attitude toward the role of women in society over the years.

Traditionally, the differences between men and women have been used as excuses to exclude females from certain jobs. Occupational segregation is the term that has been used to describe the heavy concentrations of men and women into different jobs. For example, occupational segregation supposedly explains why men dominate managerial positions while women are often consigned to other occupations with lower pay, status, and responsibility.

Specifically, Fierman (1990) reported that only nineteen of more than four thousand people (less than half of one per cent) listed as the highest paid officers and directors of the largest eight hundred public U.S. companies were women. The number of women in management positions is influenced by the perceptions of men who have traditionally dominated the upper echelons of business organizations (Heilman, 1995). An argument can be made and supported by considerable research that the discouraging plight of women in management is a result of negative stereotypes held about them. Schein (1973, 1975) reported that both male and female middle managers perceived that successful managers in general possessed characteristics ascribed more to men than to women. These characteristics include among others aggression, dominance (Copeland, Driskell, & Salas, 1995), and achievement orientation (Adler, 1988). In fact, the characteristics (e.g., co-operative and communicative) that have often been ascribed to women are considered 'unmanagerial' (e.g., Powell & Butterfield, 1979). It is therefore not surprising that women represent a very low percentage of top executive positions and are often not considered for expatriate assignments (Adler, 1988).

While sex role stereotyping of managerial work can not only result in the perception that females are less capable or qualified than males to hold managerial positions, it may also hinder the entry of women into the upper hierarchies of business organizations. Schein (1978) concluded that such stereotyping tends to reduce the opportunities for females to advance within

business organizations even though the perceived sex differences do not actually exist.

A specific area of study within the general attitude toward women's role is that pertaining to women managers in particular. Since managerial ranks have been dominated by men historically, the present study attempts to investigate the potential moderating effects of 'getting an education' on the attitude toward women managers using a sample of business students at a university in the southeastern part of the United States. By sampling a group of students at the beginning stages of their business education and another group that's graduating, we are interested in looking at the variations (if any) in attitude toward women managers. Our hypothesis is that the graduating students will have more positive attitudes toward women as managers than those students at the beginning stages of their business education.

Method

The questionnaire used was the Women as Managers Scale (WAMS; Peters, Terborg & Taynor, 1974). The Women as Managers Scale was chosen because it has been used extensively in previous studies that have attempted to measure attitudes toward women managers, particularly in the United States. However, it has also been used to investigate differences in attitudes toward women as managers across various nations including professionals in Nigeria (Adeyemi-Bello & Tomkiewicz, 1997) and Chile (Cordano, Scherer, & Owen, 2002). The Women as Managers Scale consists of 21 statements about women

as managers (e.g. "It is acceptable for women to compete with men for top executive positions"). Respondents indicate how strongly they agree or disagree with each item on a 7-point scale from "strongly agree" to "strongly disagree."

Scores ranged from 71 to 147 for Strategic Management (graduating) students and 84 to 139 for the Organizational Management (introductory) course amongst our respondents, with the highest scores indicating more favorable attitudes toward women as managers. The highest and lowest scores for males in the sample were in the strategic management course. Similarly, the minimum and maximum scores for the introductory management course were also both males. The psychometric properties of the scale have been detailed in Peters, et al. (1974), and Terborg, Peters, Ilgen & Smith (1977) presented evidence for the construct validity of the scale and support for its reliability is provided by Ilgen and Moore (1983).

Significant differences for stage of education and gender were tested using analysis of variance (ANOVA) on the total WAMS score and multivariate analysis of variance (MANOVA) for the entire 21 item questionnaire. Significance was also tested (using MANOVA) between same sex groupings and stage of education (early stage females versus upper class females, early stage males versus upper class males) and sex groupings based on stage of education (early stage males versus early stage females, etc.). Standard deviations across all 21 items of the WAMS were examined, using paired t-tests. Analysis of variance was used to compare the total WAMS score between 'graduating' male students

And 'earlier stage' male students and 'graduating' female students and 'earlier stage' female students.

Results

There was no statistically significant difference between graduating students and those in an earlier stage of their business education. Furthermore, no significant differences in scores were observed for the females in the introductory (133.26) and the strategic management (mean was 133.33) courses. Similarly, the comparison of males in both courses yielded no significant results in their attitudes toward women managers. The mean scores were 109 for the introductory course and 111.7 for strategic management for the male students.

The comparison of the males and females in the introductory course yielded significant results at $p < .0001$. The actual means were 109 and 133.26 for males and females, respectively. For the strategic management course, the mean was also significant at $p < .0001$. The means were 111.7 for males and 133.3 for females.

The overall means for males and females in the study was significant at $p < .000$. The means were 107.6 for males and 128.4 for females. The standard deviation for the male scores was 17.2 and 13.3 for females. Therefore, the female scores were more homogeneous than their male counterparts.

Discussion and Implications for Business Education

The main result of this study indicates that 'getting a business education' does not appear to moderate the degree of negative attitudes toward women managers. The lack of any statistically significant differences in attitudes by the stage of education for each gender lends further credence to this conclusion. Nevertheless, the lack of significant differences in the attitudes toward women managers from the two student classification groups that were used in this study is consistent with the result of earlier studies. For example, Dubno (1985) found that male MBA students retained significantly negative attitudes toward women as managers. Powell and Butterfield (1986) also found that student perceptions of the "good manager" had not changed significantly in its male-dominated characteristics. Furthermore, Heilman, Block, Martell, and Simon (1989), found that women in contrast to men continue to be seen as having characteristics that are "unmanagerial".

The results of this study and previous ones indicate the need for better instructional and socialization schemes for students receiving a business education. Specifically, there's a need for institutions offering business education to be intentional in incorporating more examples of successful women managers in their curriculum. Textbook authors for the introductory business courses can make a conscious effort to add more examples of organizations that are led by women. Similarly, the case writers for strategic management courses can focus more on organizations with female chief executives. Currently, it appears that from the introductory business courses through strategic management as the

capstone, there is limited, almost nonexistent, focus on organizations led by women. As a case in point, the strategic management textbook that is in use at the university where these samples were drawn has 26 cases and only one of them has a female CEO. While the focus by case writers on the biggest multinationals is understandable, the lack of diversity in the collection of cases (at least by gender) should be cause for concern.

As listed in Forbes 'The World's 100 Most Powerful Women;', there are a number of multinational corporations with female CEOs including Yahoo, PepsiCo, Wellpoint, Kraft Foods, DuPont, Archer Daniels Midland, Sunoco, and Xerox. Furthermore, non-US corporations such as Absa Group Banks, Temasek Holdings, Areva, and AngloAmerican also have female CEOs (<http://www.forbes.com/wealth/power-women>). In essence, there are now more multinational corporations with female chief executive than at any time in recent history. Therefore, the progress that is being made in the board rooms of these multinational corporations need to be better reflected in the education of business students in the classroom.

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Sustainable Strategic Management: The Case of Poland

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Sustainable Strategic Management: The Case of Poland

ABSTRACT

This paper reviews sustainable strategic management (SSM) activities and examines how one nation has changed and performed within the framework of SSM principles. Economic, environmental, and social factors that shaped the development of SSM policies in Poland are outlined. The nation has enjoyed significant economic advances during the last three decades, but the nation now faces a number of challenges to manage rapid economic growth while ensuring environmental and social stability. The relationships between market and environmental sustainability are dynamic and this case study of Poland illustrates some of the problems in conducting national policy. This provides insight into the factors and elements of concern to policy-makers, managers, and social scientists.

Keywords: sustainable strategic management, stakeholders, core values, economic development, new way of thinking, market sustainability, environmental sustainability.

Sustainable Strategic Management: The Case of Poland

Most definitions of sustainable development express the idea that progress should be viable for the long-term but must also address environmental problems of growth in a way that preserves both the physical and social basis of future generations. The core of sustainable development is the connection among economic, ecological, and equality goals. Economic affluence should be accomplished based on efficient allocation of resources, ecological long-term equilibrium, and equal opportunities for present and future age groups. Ecological problems are interrelated to economic activities and economic development (*Strategy for Poland*, 2006).

Over thirty years ago, Poland was considered a communist-controlled country with a low probability of participating in rapid economic and social developments or joining the progressive Western European nations. A major transformation occurred and the nation and its people have been rebuilt.

While Poland was making the transition from a command-oriented economy to a free market economy, a variety of issues relating to sustainability surfaced. Poland had more pressing issues to resolve before tackling the numerous areas with the environment and other social program strategies. When Poland became a market economy, the nation had to consider growth and development in terms of not just its present generation, but how economic development decisions will affect the future of the country. The debate about sustainable development began in the second half of the 1980s when attention was focused on environmental goals, provoking questions about improving the efficiency of environmental policy.

Poland joined the European Union (EU) and embarked on various strategic sustainable management programs. As a first step, the Polish government has made progress toward

resolving budgetary deficits. Working with the EU administration, the Polish government has developed strategic plans to accomplish major goals in a variety of areas including the environment, social responsibility, and human development through health and education (*Strategy for Poland*, 2006).

This paper reviews SSM principles and examines Poland's performance in attempting to manage its economy within the framework of SSM principles. The first section of this paper discusses the issues of strategy, sustainable strategic management and how it has evolved organizationally and nationally. The second section provides an overview of Poland regarding its demographics, its economic growth, its environmental response and social development over the last three decades. This section focuses on what has been done to implement SSM in Poland. The final section addresses the future of SSM in Poland.

Sustainability

The notion of sustainability has been used in a variety of contexts, including competitive advantage (Barney, 1991), ecology (Stead & Stead, 1994, 2000, 2004), and even quality management (Svensson, 2006). Based on common usage, sustainability in our context refers to the extent to which an action deemed successful in one time period can sustain or enjoy similar success in future time periods. This does not lessen the complexity of our core task, however, defining sustainable strategic management. Because strategies produce multiple outcomes, a strategy may sustain one type of performance but not another.

Within the context of organizational strategies, two broad realms of sustainability can be identified. *Market sustainability* refers to the extent to which a strategy's success can achieve a desired level of financial performance while enduring current and potential changes across

competitors and markets. In general, this form of sustainability is consistent with the notion of “sustainable competitive advantage” inherent in the resource based theory of the firm (Barney, 1991).

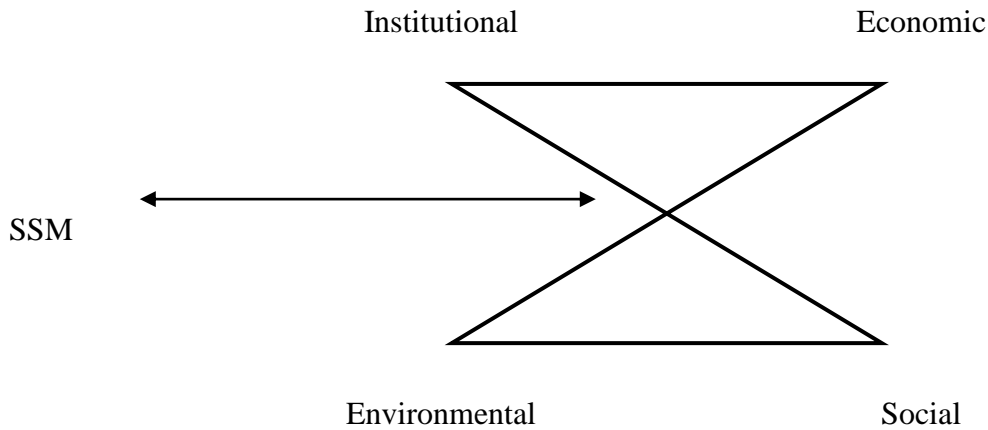
In contrast, *environmental sustainability* refers to the extent to which a strategy’s success is compatible with the firm’s general environment over the long term. Environmental sustainability considerations include such issues as the natural environment and the ecology, political-legal and regulatory concerns, and crisis management.

Regardless of the vernacular, most studies that address one of these types of sustainability tend to avoid the other type. Some exceptions exist in select topics, such as recent work that has evaluated consumer preferences for various corporate environmental stances (Sangle & Babu, 2006, 2007).

Based on the previous discussion of strategy, performance, and sustainability, a definition of sustainable strategic management can be proposed: *SSM refers to the strategies and related processes associated with the continuity of superior performance—broadly defined—from both market and environmental perspectives.*

SSM’s distinctiveness can be readily seen by considering the link between the two types of sustainability. When market sustainability and environmental sustainability are examined simultaneously, however, three broad possibilities emerge, as depicted in Figure 1.

Figure 1. Sustainability Categories



(Source: Adapted from Čiegis, Remigijus Dalia Gineitienė, 2008)

First, a strategy that lacks market sustainability—regardless of its environmental sustainability potential—is potentially useful only in the short-term. Whether or not the strategy is environmentally sustainable has relatively little importance because the strategy is not sustainable from a market perspective. Its effectiveness, if any, is transitory.

Second, an ideal strategy is one that possesses both market sustainability and environmental sustainability. Organizations pursuing such a strategy can sustain competitive and market changes with an approach that (1) manages external resources appropriately, (2) neither succumbs to nor invites government regulation, and (3) minimizes potential losses from unexpected organizational crises. Developing this type of strategy is elusive at best because doing so often assumes that organizations formed specifically to pursue market sustainability will voluntarily balance this pursuit with environmental sustainability (Lee & Ball, 2003).

Third, when a strategy possesses market sustainability, but not environmental sustainability, it is compromising some degree of the environment in favor of traditional firm

performance. Such a scenario has sparked scholarly interest in fields ranging from biology to business ethics (Stead & Stead, 1994). This situation is threatening to society because the same strategy that presents an environmental threat also generates firm profits, thereby fostering its perpetuation.

Although the optimal quadrant—high market sustainability *and* high environmental sustainability—is most desirable, it is difficult to achieve. Instead, many successful firms pursue strategies more closely aligned with the third quadrant. Achieving market sustainability at the expenses of environmental sustainability creates a key concern, however, and ultimately leads to a number of vibrant research opportunities.

The sub-discipline of sustainable strategic management is marked by two key approaches. First, *SSM requires an interdisciplinary approach*. A key goal of SSM research is to identify processes and characteristics associated with strategies sustainable from both market and environmental perspectives; hence, pursuing it requires expertise from disparate fields, including those within and outside of the traditional business domain. Calls for greater interdisciplinary research in the management field are not new; however, the nature of SSM makes such a call for this research an imperative.

Strategic management scholars, for example, are adept at issues associated with strategy content and process. Strategy researchers—in concert with experts in finance and accounting—are well equipped to tackle issues associated with organizational performance. Competitive analysis is a strategy domain as well, but also benefits via contributions from economists. Sustainability of customer demand is at its heart a marketing issue.

The concept of environmental sustainability opens the door to contributions from a variety of disparate fields. Legal scholars analyze the regulatory environment. Biologists and

other scientists wrestle with ecological and natural environment concerns. Economists and public administration scholars address resource management issues (Barton, Jones & Gilbert, 2002; Nijkamp & Soeteman, 1998). General management scholars, strategic planners, and numerous crisis-specific experts in medical and emergency management disciplines grapple with crisis management, preparedness, and disaster response. The field of SSM achieves progress when one or more issues associated with market sustainability are addressed vis-à-vis one or more issues associated with environmental sustainability.

Second, *SSM research—to advance the field—must be committed to both the needs for a vibrant free market system and the recognition that what is “best for business” in the short term is not always desirable for society.* Traditionally, scholars in the aforementioned fields have not shared a commitment to both concerns. In a general sense, most published strategic management studies are concerned with organizational performance in a free market economy and *appear* to overlook that a primary goal of a free market system is to enhance a society’s quality of life.

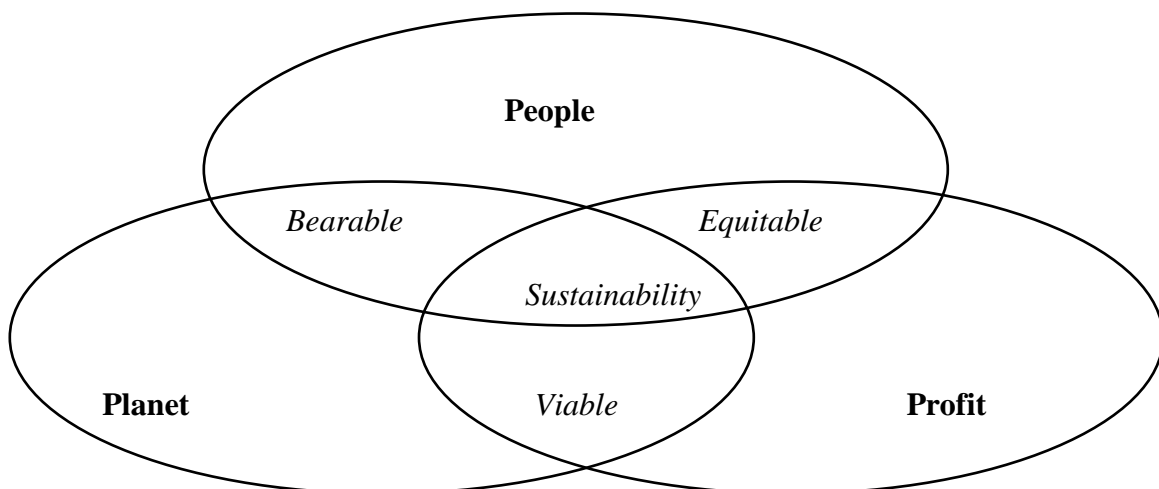
On the other hand, scholars in the environmental sciences *appear* to be calling for more centralized regulation and control and do not seem to appreciate the role played by a free market. SSM research should be marked by recognition that *both* market sustainability and environmental sustainability are equally important. Presumably, addressing both concerns requires trade-offs (e.g., Porter, 1996), but validity of such an assertion remains untested.

The importance and reality of these sustainable strategic management concepts, constructs and parameters can be illustrated using Poland as an example of active and ambitious attempts to really implement the spirit and substance of these principles. However, SSM is not an occurrence restricted to a single organization or a single country. It is a management action

required for all organizations all over the world. As global markets emerge and transform, organizations have to respond to these dynamic challenges with new and innovative ideas.

Contemporary organizations have to learn different methods for focusing on profits while also considering other issues such as social and environmental concerns. A sustainable management approach shifts towards integrative corporate policies. This approach is known as the triple bottom line (Čiegis, Remigijus, & Gineitienė, 2008). Figure 2 illustrates the integrative relationships that are established for each dimension and need to be included in the strategic thinking of corporate managers.

Figure 2. The Triple Bottom Line



(Source: Adapted from Čiegis, Remigijus, & Gineitienė, 2008)

Strategic sustainability links an organization's continuing ability to guard and grow shareholder value through confidently managing its contacts with relationship and diverse stakeholder constituencies. This involves integrating economic social and environmental issues and opportunities with decision-making activity and applying them to achieve business goals.

Corporate strategy takes into account environmental and social opportunities as part of business opportunities and creates strategic capabilities to exploit these possibilities efficiently (Spillan, et al, 2008). The accent is on visible and verifiable stakeholder-driven sustainable business operations.

Three stages of sustainability can be distinguished and modeled. These are as follows:

A) Two-dimensional Sustainability

With the beginning evolution of sustainable development concept, business sustainability and the impact on the environment were noted. Emphasis was placed on the fact that the economy and the environment must not limit each other but help find new possibilities.

According to Čepinskis et al. (2002), the biggest attention was given to eco-effectiveness, which was understood as manufacturing and the supply of competitive goods and services. To improve quality of life, the environment, and commonwealth, without limiting possibilities to meet, Čiegis (2000) noted that development and protection are not conflicting cases. A well-balanced use of natural resources is not only a part of economic development, but also a part of environmental protection. Čepinskis et al. (2002) stated that during this period the necessity to base development on renewable resources (informational, financial, human, natural, and recycling) was realized. The use of the resources is based on rationality according to the principles of effectiveness and modern value creation principles.

B) Three-dimensional Sustainability

The third dimension, social, was added to the two dimensions– environmental and economic. For some time, sustainability between economic growth, ecological stability, and social development were dominating. Čaplikas (1999) noted that at this stage a concept of “social effectiveness” was created. Social effectiveness is a connection between the value

created by the nation and the activity needed to create it.

Development had to turn towards national economic development, as well as to stimulate adequate preparation of an ideological base for developing effective management means. This has been a qualitative turn to the following: information technologies, the improvement of legal, management, technical environmental protection conditions, the globalization of political structures and businesses, as well as the integration of social institutes and markets for continuous social growth (*National Strategy of Sustainable Development of Lithuanian Republic*, 2003).

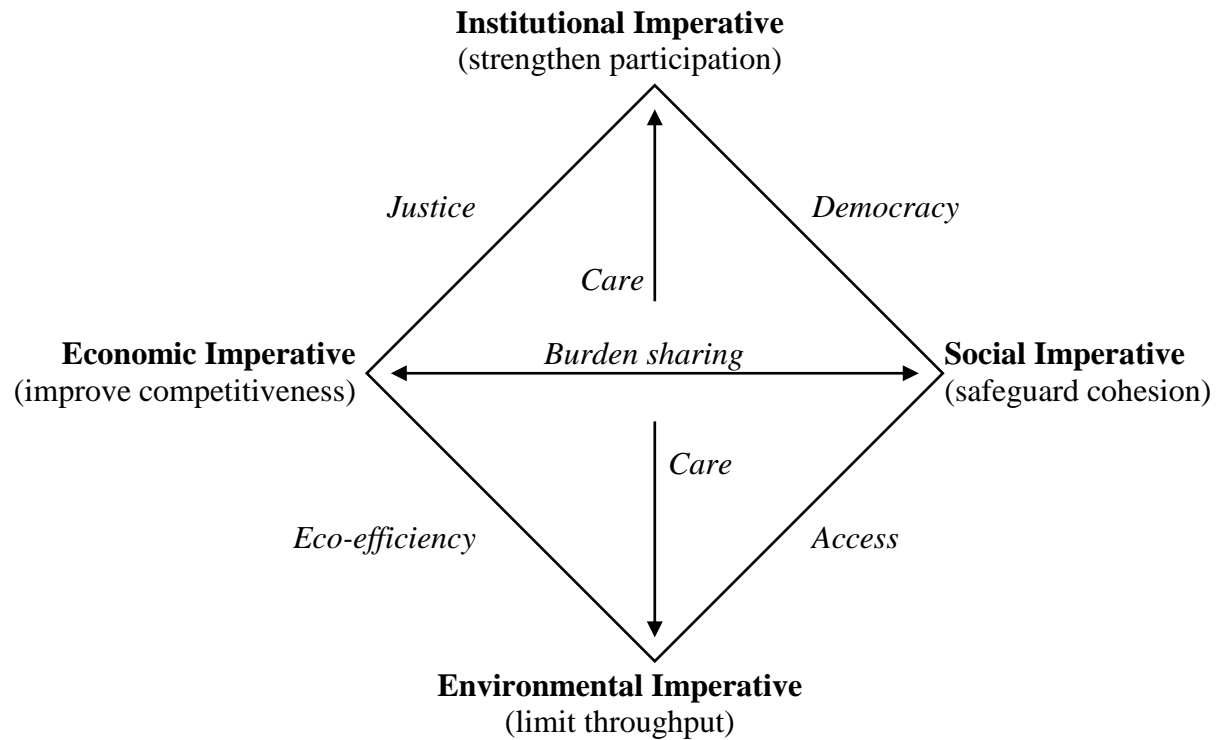
The concept of “sustainable development” was mentioned for the first time in the World’s *Environmental Development Commission* document “Our Common Future” (1987). This report stressed that the sustainable development should be based not only on matching economic and environmental interests, but also on guarantees of social justice in internal and international affairs. Poverty was identified as one of the basic difficulties to implementing sustainable development principles (Ciegis & Gineitiene, 2008).

C) Four-dimensional Sustainability

The three dimensional model fails to include the political-institutional dimension. It is not only a critical component, but also this dimension is part of the transformation process from central planning to democracy; thus properly functioning institutions are essential for sustainable development (Čiegis, 2004). In 1992, as the result of the international Rio de Janeiro Conference, a detailed program of actions known as “Agenda 21” (2001) was accepted (*National Report on Sustainable Development*, 2002). This document described how sustainable development should be implemented in all the spheres and levels of life, estimating economic, social, ecological, territorial, political, as well as the institutional aspects (Čiegis 1999). It is

possible to illustrate the four dimensions in Figure 3.

Figure 3. Four-dimensional Sustainability



(Source: Adapted from Čiegis, Remigijus, & Gineitienė, 2008).

This diamond, four-dimensional description of categories of sustainability is analogous to the economic terminology of human made, natural, social, and human capital used as was described by Serageldin (1996). This structure can be distilled from the list of 134 indicators of sustainable development that was described by the UN Sustainable Development Commission (1996).

The following section focuses on how the principles of strategic sustainable management are implemented in Poland.

The Case of Poland

As Poland moved through the transition from a command-oriented economy to a free market economy, many issues of sustainability became apparent. This was evident in how the natural environment was left to languish in Poland. Moving to a market based economy also refocused concerns about the nation's growth and development in terms of not just its present generations, but how economic development decisions will affect the future of the country. While the debate about sustainable development which began in the second half of the 1980s, numerous voices had already focused attention on environmental goals and provoked questions about improving the efficiency of the Poland's environmental policy.

Most definitions of sustainable development express the idea that progress should be sustainable but must also address environmental problems of growth in a way that preserves both physical and social basis for future generations. The core of sustainable development is the connection among economic, ecological and equality goals. Economic affluence should be accomplished based on efficient allocation of resources, ecological long-term equilibrium and equal opportunities for present and future age groups. Ecological problems are interrelated to economic activities and economic development (*Strategy for Poland*, 2006).

Environmental Issues

Poland continues to encounter environmental problems regarding air, water, and soil pollution that require large investments and the participation of both public and private sector. Problematic air pollution from power stations and other industrial plants, particularly heavy metals, motor vehicles, and domestic heating require major attention. While air quality is generally improving, emission of PM₁₀ remains a problem in many areas. This situation was evidenced in January 2006 when a combination of cold weather and unfavorable atmospheric

conditions, generated health warnings in the Katowice area where people advised to stay indoors because the air quality exceeded EU ambient air quality standards. Substantial improvements are needed in the area of waste management, wastewater treatment plants, improving drinking water quality, and reducing groundwater pollution. Also, the subsequent implementing, enforcing, and controlling of integrated pollution prevention at industrial facilities is needed in Poland. The National Municipal Wastewater Treatment Program adopted in late 2003, foresees the modernization and/or expansion of 1,100 municipal wastewater treatment plants in over 1,577 communities and the construction of 37,000 km of sewerage networks. This will be a costly undertaking but it will generally resolve the major waste treatment issues meet EU standards. The newly elected Government is continuing with the Environmental Policy that has been developed since the early 1990's (*Strategy for Poland*, 2006).

In line with the Aarhus Convention, legal bases have been established for access to environmental information and to the courts, although access to information and public consultation needs to be further reviewed and substantial capacity building is still required. (*Strategy for Poland*, 2006; Čiegis, & Gineitienė, 2008).

Poland has now adopted all of the EU's environmental law (The 'Acquis Communautaire'). The *Acquis Communautaire* comprises over 200 legal acts covering different areas such as water and air pollution, waste and chemical management, nature protection, industrial pollution management and noise protection. Poland has obtained transition periods for 10 Directives including for waste management, urban wastewater treatment as well as Integrated Pollution Prevention and Control Directive (IPPC) and the Large Combustion Plant Directive (LCP). In terms of LCP, waste management and IPPC the derogation is applicable to named installations in the Accession Treaty.

Implementing the requirements of the IPPC and LCP Directives will have a major impact on the competitiveness of Polish industry, although may provide opportunities for energy efficiency gains. Problems may arise in Poland with the delimitations of installations under the IPPC permitting system, and therefore how to apply Best Available Techniques, as well as the definition of combustion plant under the LCP Directive and whether the boiler or stack concept should prevail. The latter may result in the need of expensive abatement equipment (more efficient dust arrestment and flue gas desulphurization) at small and medium sized combined heat and power plants.

Full implementation of the environment *acquis* is anticipated to still pose a major challenge, both financial as well as institutional. Although Poland has fully transposed the *acquis*, there is still need for substantial work, and for instance, the Environmental Protection Law from 2001 has already been amended over 20 times and further amendment is planned.

One of the more controversial issues has been associated with Environmental Impact Assessment procedures and public consultations. Often the need for approving projects, many EU funded, has conflicted with the requirements for full and open public consultations. The EIA process has therefore sometimes been inadequate and resulted in delays in approving the disbursement under EU funding (*Strategy for Poland, 2006*).

The municipal infrastructure sector (landfills and wastewater treatment plants), will continue to require substantial investment to deal with past legacies as well as developing new solutions to meet future economic growth. Poland will have to have a continuous sustainable strategy that will allocate its resources sufficiently to meet the economic goals while simultaneously focus attention on sustainable development. EU and domestic funds will account for a large amount of the investment

The power and energy (including mining) sectors continue to be one of the major sources of industrial pollution. To correct or abate the environmental problems that exist here, Poland will have to invest substantial resources to meet future EU environmental standards. Additional resources will probably be needed to acquire more abatement equipment in Poland's heading district due to the possible change in definition and interpretation of what a combustion plant means. As such, there is a major requirement for continued financing of environmental projects. Poland has been able to transpose and implement most of the EU's environmental law (the '*Acquis Communautaire*') (*Strategy for Poland*, 2006). While substantial progress has been made, several practical implementation issues have emerged, for example, the inadequate transposition and implementation of the EU Directive and the Natura 2000 requirements. These obstacles are part of the process for moving along the continuum of development. Making choices that adhere to the law and EU requirements what at the same time finding the resources that will allow implementation of the actions is an ongoing challenge. Poland is working diligently to assure the highest level of goal attainment in this area.

Population Issues

Poland has the largest population in Central and Eastern Europe. At the end of 2004, the population of Poland was estimated to be 38.2 million. One of the major concerns for sustainable development policy making is the fact that it continues to have a negative annual growth rate growth of -0.2%. Another concern in this area is that Poland's population is expected to age rapidly. This demographic situation would have put an insupportable drain on the country's pension systems had it not been reformed in 1999. Accompanying the trend of other Western countries where young people are delaying having children, Poland also has a

serious housing situation, which makes family accommodation very difficult for young people.

With housing being a problem and employment also requiring more education and investment of resources, Poland has some major sustainability issues that need to be debated, and policy solutions need to be developed to build a population, housing and employment situation that is positive for Poland's future generations (*Strategy for Poland*, 2006).

Educational Issues

Poland's education system under socialism was successful in offering a high degree of literacy and numeracy. Education, like other public services, suffered from a drop in pay and status compared with the other sectors of the economy in the 1990s. Measures have been aimed at improving pay. Nevertheless, the quality of education in rural areas needs to be addressed because rural schools find it difficult to attract good teachers. The Polish higher education system has been modernized and offers a broadened curriculum.

The Constitution guarantees free higher education, but in practice most students pay some fees since public universities now receive less government funding to provide. The participation rate in higher education has risen sharply from around 10% during the 1980s to 35% in the 2003/2004 academic year. Higher education has also seen a flourishing private sector complementing the established public institutions. There were 274 private university-level schools in operation during the 2003-2004 academic year. Of the 1.86 million student places in 2003-2004 academic year, almost 546,000 students were in private institutions. Forty-six of these private institutions have business schools (Ciegis and Gineitiene, 2008).

Competition between the state and private sector institutions seems to be intensifying with the private sector expanding daytime provision at the same time as the state sector expands

evening and weekend study. These are good signs because they focus on the future and open the opportunities for a sustainable future. Better education generally means better ideas and an opening of new thinking about the impact of old ways. It offers hope for a more enlightened citizenry and thus a society that is able to focus attention and resources on sustainable development (*Strategy for Poland, 2006*).

Health Issues

The financing and management of health services were restructured in 1999. However, based on current information these reforms were the least successful of the four major structural modifications. While everyone is able to obtain basic health care, improvements in quality and expansion of the services is a critical direction for Poland (Ciegis & Gineitiene, 2008).

Life expectancy of Poles at birth in 2003 was 70.5 years for males and 78.9 years for females. High alcohol consumption and smoking are prevalent in Poland and have been identified as a major health problems. Poland also has a poor road safety record. In 2002, there were 152 road deaths per million in population, the third- highest level in OECD after Portugal and Greece. The number of road deaths is decreasing by falling from 6,900 in 1995 to 6,294 in 2000 and 5,640 in 2003.

Government Policies

Poland has articulated a number of major initiatives in moving towards strategic sustainable development. Some of those objectives are presented below:

- Development of National Environmental Security objectives, meant to make certain the biodiversity, improvement of air quality in accordance with climate change conventions as

well as improving the quality of water.

- Sustainable development, with opportunities and use of biodiversity. Poland's environmental management is founded on solid environmental institutions and competencies. Poland's national Inspectorate for Environmental Protection is completing inspection and enforcement obligations as required by law.
- Spending on pollution abatement and control has largely been financed by high pollution charges and fines (e.g. for air pollution) redistributed through the National Fund for Environmental Protection and Water Management and a number of other environment funds operating at regional and local levels.
- Poland expanded its use of economic instruments significantly to implement environmental policy and to recover the operational costs of environmental services (e.g. drinking water supply, waste water treatment). The State owned Environment Bank (pol. BOS S.A.) is seen as one of the pillars of future financing of environmentally related projects (Ciegis & Gineitiene, 2008).

The country has ratified and implemented international conventions and is active in developing international policy frameworks. Its legal framework for international shipments of hazardous waste is consistent with the Basel convention. Poland has completed the ratification process of the United Nations Framework Convention on Climate Change and its Kyoto Protocol in 2002.

Poland made considerable progress by introducing new regulations in waste management and nature protection areas, including Natura 2000 sites. The country has continued to carry out some capacity building and training actions to develop its administrative capacity in the field of the environment on the national and regional levels (Ciegis & Gineitiene, 2008).

These efforts are ongoing and are part of Poland's strategy for sustainable development. As with all countries, economic development and sustainable development require major analysis of policy priorities. Finding sufficient resources for application to extremely important competing projects is an enormous challenge. Nonetheless, strategic sustainable management is about the future and if countries are to have a quality and vibrant future, the policy makers must allocate resources to this important endeavor of SSM.

Local communities are important participants of physical and social resources management. Transitional period and growing competition make municipal representatives look for rational planning and community management instruments, which allow a better coordination of sustainable development processes in seeking high quality of community living environment. Sustainable development strategic planning becomes a challenge for the administration of local governments and leaders of local communities.

Although a local community may be too small to observe architectural, social, economic, political, and natural imbalance which may have negative impacts; the problems may also be too big for the locality to solve the problems by itself, according to the criteria of integration versatility and sustainable development:

Social, Economical, and Environmental (Value Set)

Action programs must also include a territorial (spatial) development aspect. This originated because of the rapid development of sprawling urban territories that pose dangers to existing ecosystems. (Ciegis & Gineitiene, 2008, *Strategy for Poland*, 2006). The sustainable approach is to use currently occupied territories. Analogous to "brown-field" development, the "used" territories should be exploited first, and only after that should the development of new

ones start. As development expands into the future, it will include more dimensions of the environment. Subsequent development will become more complex and complicated to manage. Decision-makers at all levels will need to consider more aspects, and use a systematic way of thinking. Considering the variety of sustainable development definitions and their different approaches, the central agreement is in the following four criteria of sustainability (Pathways to a Sustainable Future, 2001):

1. Sustainable development as universal empiric phenomena was developed progressively; at the same time it was changing by the impact of various processes and dimensions. Seeking to analyze evolution of sustainable development over time, a number of dimensions could be used.
2. Strategic plans of sustainable development of some communities realize the goals declared in global documents of sustainable development. The most important of those goals is the direct involvement of community and keeping it interested during the whole process. That is why local authorities should give possibilities to their community members to solve their general and specific problems in public meetings, forums, conferences, etc.
3. It is not possible to create a universal sustainable development planning system for all communities, because they are different in their areas, number of population, environment, political, and social-cultural conditions. Sustainable development strategic planning in local communities provides justice within the frame of one generation and between different generations. Analyzing sustainable development of a city, it is necessary to consider, that a city from its origin is unnatural and very dynamic environment, where various aspects of natural environment were sacrificed for creating urban agglomerations. According to Čiegis (2001), the fact that densely settled cities “put” a very big economic footmark is not only a

sign of non-sustainability, but also the result of a special arrangement of spatial factors and specialization types. To implement a sustainable city policy it is necessary to have a strategy, which combines a lot of aspects, where social and economic interests match environmental and cultural interests as well as foresee progressive changes, stimulating this process. Considering the growing tendency that the cities use a lot of not local resources, as noted in Gailius and Draugelis (2001), the sustainable development of cities could be described as “development warranting that local inhabitants can reach and maintain the level of well-being, which is acceptable for them and has a growing tendency, without causing danger to the inhabitants of neighboring regions”. Because communities are different in their territory, number of population, environment, political and social-cultural conditions, local authorities together with society of each of them should find individual way of sustainable development. Participation of inhabitants in various aspects of local life is especially important, because communities in some sense are products of their inhabitants (Čiegis, & Gineitienė 2008). Authorities find ways for developing sustainable development together with the inhabitants of their communities.

4. There is no official methodology for strategic planning, and communities use various methodologies prepared by various consultants and institutions. Different methodologies are used by different levels of strategy preparation and the problem of making them to work together appears and becomes reason for failures of their implementation. Universal methodology for sustainable development strategy preparation could be prepared and used. As basis can be used the methodology, which was developed in cooperation with the Umbrella association of consultants under UNDP office in Poland.

The need for the economic revival of rural areas, combined with the growing emphasis

on sustainability, has created a new challenge for tourism as a potential means of achieving these two political goals simultaneously. The development of sustainable rural tourism has become a priority of national tourism policies and/or strategies in many countries.

The essence of sustainable development is the connection of economic, ecological and equality targets. Economic prosperity should be achieved on the basis of efficient allocation, ecological long-term equilibrium and equal opportunities for present and future generations. Ecological problems are related to economic activities and economic development (Čiegis, & Gineitienė, 2008).

Future Concerns

Poland still faces environmental problems concerning air, water and soil pollution. The municipal infrastructure sector (landfills and wastewater treatment plants) will continue to require substantial investment to deal with past legacies as well as developing new solutions to meet future economic growth. EU and domestic funds will account for a high proportion, but not all, of the required financing.

Poland has been able to transpose and implement most of the EU's environmental law (the '*Acquis Communautaire*'). Even though good progress has been made, a number of practical implementation issues have been noted, for example, inadequate transposition and implementation of the EU EIA Directive and Natura 2000 requirements. This affected disbursement of EU Cohesion Funds for a number of municipal infrastructure and transport projects in 2005.

As a result of EU and NGO action, the EIA and Natura 2000 legislation has been amended and the non-compliance partially addressed, although further institutional strengthening and legislative changes may be required. Poland has also obtained substantial derogation periods

in terms of implementing some key EU Directives, notably in the power and manufacturing sectors (Large Combustion Plant (LCP) and Integrated Pollution Prevention and Control (IPPC) Directives) as well as for municipal waste and wastewater infrastructure (EU Urban Wastewater and Landfill Directives). Attaining full compliance will require substantial investment and will remain a priority investment focus for the next decade. (*Strategy for Poland*, 2006; Čiegis, & Gineitienė, 2008)

Poland made considerable progress by introducing new regulations in waste management and nature protection areas, including Natura 2000 sites. The country has continued to carry out some capacity building and training actions to develop its administrative capacity in the field of the environment on the national and regional levels (many through PHARE funded projects). This has included work on introducing EMAS to industry as well as integrated product policies. Poland continues to make significant investments in the field of the environment; however it still needs to apply more efforts to establish comprehensive investment strategies that would improve investment efficiency by focusing the available resources on implementing the requirements of the EU environmental *acquis*. *Harmonization with EU Environmental Law*. (*Strategy for Poland*, 2006).

Due to its less intensive agriculture and forest management, the country has maintained its rich biodiversity and valuable landscapes. Poland has had to adjust its legal framework to the provisions of EU Environmental Law despite the new pressures of more intensive forms of land use like road construction, traffic, or agriculture after integration into the common market.

The realization of social guarantees must continue to be supported by integrated sectoral policies and programs of social policy, financial and tax policy, health policy, environmental protection, education policy, labor policy, countryside development policy or immigration

policy. Non-governmental actors in at least all sectors must have a role in this process along with school systems, universities, local governments and organizations, research and development institutes, and trade unions. The institutional restructuring of the political and administrative system must also be supported by the media and the Catholic Church (Zieschank, 2004). Decisions on local use of natural resources are the responsibility of regional administrators but their ties to national activities must be strengthened in order to provide consistency (intergovernmental coordination) in the Polish approach along with an adequate monitoring and reporting system in place. The dimensions of sustainability: dynamics of economic growth, life standard, level of employment, the quality of the environment, and the rational use of resources, must remain the overall strategy throughout Poland.

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USING ACHROL'S UNCERTAINTY SCALES TO MEASURE INFLUENCE IN CHANNELS

INTRODUCTION AND LITERATURE SEARCH

The sociological setting of channel operations from the behavioral perspective has been couched mainly in terms of power in the political sense [6] [13] [14] [16] among others. Power is present in these channel dyadic interactions in which the seller is attempting to influence the buyer and gain his cooperation and participation in the marketing program. But this presence is as an implied operant and is not the main mechanism at work. This paper proposes the idea that the sociological mechanisms used to gain this cooperation and participation are the main instrument through which this influence is accomplished and that power is a natural corollary or result of these mechanisms. This suggests that the understanding of channel operations would be better served by examining the sociological phenomena involved rather than the expressions of power which are among the results of these mechanisms and indeed are sociological mechanisms themselves.

This paper amounts to a behavioral view of channel operations and is an outgrowth of the power stream of channels literature and is allied to it. A change in terminology will be necessary to move the focus to influence and influence attempts instead of power. Parts of this paper discuss the channel power literature and there the terminology will include such terms as Power and Bases of Power. When the focus is on the new Activation-Expectations Model on Channel Influence the terminology will include such terms as Influence, Influence Attempt, Bases of Influence and the two sociological mechanisms of influence here proposed, "Coping Tactics," and, "Persuasion by Reference." The first of these mechanisms operates through the imposition of the manipulator's actions to gain compliance, usually involving some monetary or psychological motive. The second operates through the conscious desire of the one influenced to gain closer association with the respected power-wielder due to his perceived expertise, knowledge, and leadership. These are very different sociological mechanisms.

It is through the decisions made by decision makers within organizations that influence attempts are made, perceived, interpreted and outcomes result. In the channels setting these decision makers are in the buyer-seller dyad representing the interface between the buying and selling organizations. The selling organization is attempting to influence the buying organization in this case, so the sampling point will be the buyer.

The recipient of the effects of power (the buyer in our buyer/seller dyad) is under the influence of positive or negative sentiment, which one depending on the actions of the seller and the buyer's expectations. The paper now moves on to the Bases of Power and the Power-Dependence Theories.

The Bases of Power Theory of Power

The Bases of Power Model originated in the works of Dahl (1957) [6]. The definition

of power used with this model is the, “ability to influence,” form from el-Ansary and Robicheaux (1974) [9]. It defines power as:

...one channel member’s ability to affect the probability of another channel member’s compliance [17, p. 105]

The components of Dahl’s model are shown in Figure 1. The first element of this model is the Bases of Power which includes resources through which the power-wielder exerts influence

The second element is the Instrument or Means which is some mediating action by the power wielder which has an effect on the recipient, as with the initiation of a promotional campaign which then activates a base or bases of power in Figure 1. The instrument galvanizes the previously dormant base or bases of power to an activated state.

The third element is the Scope of Power (Response) by the influence recipient. These could vary from support with enhanced performance and benevolent sentiment all the way to conflict with a concomitant lowering of performance and malevolent sentiment. So channel members could participate enthusiastically, somewhat willingly, non-committally, with reservations or begrudgingly.

The final element is the Amount of Power and is expressed as a statement relating a measure of means with a probability of a certain result (scope). There must be enough power used to work through the instrument to gain the desired change (scope) which was the initial intent. For example, what amount of motivational power working through the bases and the means of power is necessary to gain sufficient channel participation (scope of power) to attain a given probability of a behavioral change (amount of power)? Albeit in question form, this represents the amount of power.

FIGURE 1: THE BASES OF POWER MODEL (DAHL, 1957)

BASES (SOURCES) OF POWER	MEANS (INSTRUMENT) OF POWER	SCOPE OF POWER (RESPONSE)	AMOUNT OF POWER
-REWARD -COERCION -LEGITIMATE: -TRADITIONAL -LEGAL -REFERENT -EXPERT -INFORMATION	RUNNING A PROMOTIONAL CAMPAIGN TO ENHANCE CHANNEL PARTICIPATION AND MARKET SHARE	-ENTHUSIASM -WILLINGNESS -NONCOMMITTMENT -RESERVED -BEGRUDGING	A PROBABILITY STATEMENT RELATING PROBABLE OUTCOME (SCOPE) WITH THE LEVEL OF POWER UTILIZED

A typology of the actual bases of social power to be used in conjunction with Dahl's model of power was depicted by French and Raven [11]. Included were several types of power: reward power (the use of a reward to gain the buyer's compliance), coercive power (the use of some punishment gain compliance), and legitimate power (where the buyer complies due to internalized cultural values and social structure dictating that he should). Dahl's model also includes referent power (based on a desire to identify with the seller) and expert power (based on a perception that the seller has special expertise in this area). Information power was added by Raven and Kruglanski [20]. The legitimate power base was later divided by Lusch and Brown [19] between traditional legitimate (based on internalized cultural values and social structures) and legal legitimate (based on the power of an existing contract).

Gaski [13, p.10] writes that there seems to be agreement in the literature that the bases of power empirically studied and enumerated by French and Raven [11] are defined through the perception of the power recipient which is the perspective taken in this paper.

The Power-Dependence Theory of Power

The second model of power to be examined is the Power-Dependence Model of power from Emerson [8]. In this model, A is the power wielder, and B is dependant on A due to this power. Power and dependence exist in a reciprocal relationship. The dependence of one party on the other reciprocally becomes the basis for the power of the first party over the other.

The power of A over B was defined by Emerson as:

Power (Pab): The power of actor A over actor B is the amount of resistance by B which can potentially be overcome by A.

Power in Emerson's conceptualization then is the resistance on the part of B that can be overcome by the influence of A. Emerson's definition of dependence is as follows:

Dependence (Dab): The dependence of actor A upon actor B is (1.) directly proportional to A's motivational investment in goals mediated by B, and, (2.) inversely to the availability of those goals to A outside of the A-B relation. (Emerson, 1962, p. 32)

In the wholesale-retail dyad, the retailer would be dependent on the wholesaler, firstly, in direct proportion to the retailer's motivational investment in goals mediated by the wholesaler. Secondly, this dependence is in inverse proportion to the availability of those goals outside this wholesaler-retailer relationship.

Emerson represented the reciprocal relationship between power and dependence by the following pair of equations.

$$P_{ab} = 1/D_{ba}$$

$$P_{ba} = 1/D_{ab}$$

Lusch, [18] identifies four mechanisms by which power develops in the distribution channel through dependence. These were identified by Lusch in his investigation of power in channels in the insurance industry. They include:

- 1.) the percentage of sales attributable to the brand or supplier,
- 2.) the availability of alternatives,
- 3.) costs associated with changing suppliers,
- 4.) the possibility of tarnishing a good business image by shifting suppliers

There is another conception of power (Ecological Power) not based on the perception of the influenced [27]. This works on the ability of the influencer to manipulate the environment in which the one influenced functions. When P has the ability to control critical aspects of W's environment in such a way that the new environment will bring about a desired change in W's behavior, then P has "ecological" control over W (p. 15).

Tedeschi and Bonoma [26] state,

When P has the ability to control critical aspects of W's environment in such a way that the new environment will bring about a desired change in W's behavior, then P has "ecological" control over W (p. 15).

Gaski termed this control over information, the number of alternatives available, and any ability to modify the environment of the one influenced Manipulative or Ecological Power.

The addition of information power and division of legal legitimate power between traditional and legal legitimate power to Raven and French's five original bases, may in part cover these non-perceptual sources. The main thrust of the present paper focuses on a positive or negative interpretation being placed on the use of and indeed the presence but non-use of various influence attempts. In this sense, the non-perceptual bases are included in the bases referred to later as compliance by leadership. This would include all those influences making the influenced wish to associate with and be influenced by the influencer.

In Achrol and Stern (1988) the supplier-retailer dyad was the unit of analysis but the sampling point was the end-user. Therefore the conceptualization and operationalization were from the dyad, but the sampling point was the end-user. In the present work, the dyad is again the sampling point, but this time the dyad is between the wholesaler and the retailer, so we have moved further up the channel by one dyad. This will cause much rewording of construct items and some reconfiguration.

According to Achrol and Stern (1988):

There is little basis for expecting that vertically actors in a channel dyad share a common conceptualization or enactment of the output environment.

Consequently dyadic data collection is inappropriate to our subject matter. However, the dyad as unit of analysis remains a basic concept: the output market environment is studied via the output actor, but operationalizations are in the context of a given supplier (dyadic partner)

This is very much in line with the writer's conceptualization of the mind set of the seller and the buyer in the dyad, the use of tools to gain compliance in the seller's view but the development of sentiment including power issues in the buyer's point of view. This is a case Weick's (1969) [25] enactment theory of environments, with different enactments of the environment in the minds of those on different sides of the dyad. It is this that allows the seller's side to see the interaction as the use of tools and resources to gain compliance while the buyer's side to develop sentiment including power issues.

FIGURE 2: LINKING ENVIRONMENTAL SOURCES OF UNCERTAINTY WITH DECISION MAKERS IN THE ORGANIZATION

STRUCTURE AND PROCESS:

ENVIRONMENTAL
CONDITIONS
GIVING RISE
TO "ENVIRONMENTAL
UNCERTAINTY"

UNCERTAINTY ACTIVATED AND
ENACTED IN THE MINDS OF
DECISION MAKERS IN
ORGANIZATIONS:

- ORGANIZATIONAL
- INFORMATION PROCESSING
- DECISION-MAKING

Power Issues Being a Result of the Operation of Channel Influence Mechanisms

This work in the area of channel influence and operation focused on the power issues resulting from this operation rather than the sociological mechanisms through which this functioning proceeded and which in turn gave rise to these power issues. Several prominent writers produced articles in an attempt to classify the various types of economic and social power into more understandable and meaningful typologies. These different bases of power were outlined in the section on the Bases of Power Theory of Power above. The typologies include (Table 1): coercive vs. non-coercive [14], Economic vs. Non-Economic [10], weighted vs. non-weighted [5], direct vs. indirect [17], contingent vs. non-contingent [15] and mediated vs. non-mediated [24]. (The Sociological Mechanisms part of this table will be discussed later in the paper) This all appears to be a search for the proper way to classify the Bases of Power but its focus on power issues instead of the actual underlying sociological mechanisms may be an example of the tail wagging the dog. The power issues are derived issues, a result of the underlying sociological mechanisms. There were so many articles focusing on these power issues by so many prominent writers that the attention of the present writer was attracted. Power is the result of a sociological setting or mechanism, so "something" had to give rise to the power issues. That "something" is the subject of this paper along with a new proposed way to measure that "something," the underlying sociological

TABLE 1: THE SIX DICHOTOMIES RELATING SOURCES OF POWER AND THE BASES OF CHANNEL INFLUENCE (JOHNSON, KOENIG AND BROWN, 1985)

DICHOTOMY	SOURCES OF POWER	SOCIOLOGICAL MECHANISMS
COERCIVE	COERCIVE	-“COPING TACTICS”
NON-COERCIVE (HUNT & NEVIN, 1974)	REWARD, EXPERT, REFERENT, LEGITIMATE	-A POSITIVE REWARD -“PERSUASION BY REFERENCE”
ECONOMIC	COERCIVE, REWARD, LEGAL LEGITIMATE	-“COPING TACTICS
NON-ECONOMIC (ETGAR, 1978)	EXPERT, TRADITIONAL LEGITIMATE, REFERENT, INFORMATION	-“PERSUASION BY REFERENCE”
WEIGHTED	COERCIVE, REWARD, LEGAL LEGITIMATE	-“COPING TACTICS
NON-WEIGHTED (BROWN & FRAZIER, 1978)	EXPERT, REFERENT, TRADITIONAL LEGITIMATE	-“PERSUASION BY REFERENCE”
DIRECT	COERCIVE, REWARD, LEGAL LEGITIMATE	-“COPING TACTICS”
OTHER	EXPERT, REFERENT	-“PERSUASION BY REFERENCE”
INDIRECT (KAZULIS, SPEKMAN & BAGOZZI, 1978)	INFORMATION, TRADN’L. LEGITIMATE	
CONTINGENT	COERCIVE, REWARD	-“COPING TACTICS”
NON-CONTINGENT (JOHN, 1984)	EXPERT, REFERENT, LEGITIMATE	-“PERSUASION B Y REFERENCE”
MEDIATED	COERCIVE, REWARD, LEGAL LEGITIMATE	- “COPING TACTICS”
NON-MEDIATED (TEDESCHI, SCHLENKER & LINDSKOLD, 1971)	EXPERT, REFERENT, INFORMATION, TRADN’L. LEGITIMATE	-“PERSUASION BY REFERENCE”

mechanisms present. Later in the paper, these sociological mechanisms, Coping Tactics and Persuasion by Reference will be proposed and described along with a proposed way to measure them.

Sentiment: The Carryover Role of Influence Attempts in the Dyadic Relationship

Sentiment is an inevitable result of the use of influence attempts by one side of the dyad on the other. When the influencer is perceived to have various techniques and resources at his disposal to employ in the relationship, there will be an assessment of the treatment the influenced member of the dyad has received from the influencing party. Included in the assessment will be how the influencer conducted the interaction, what techniques or resources were employed or withheld, how they were employed and how he, the influenced, feels about the treatment he has been subjected to, all as a result of the dyadic interaction. (These various techniques and resources and how they are employed or withheld can be seen by the influenced as the influencer using power.) This can be perceived either as positive or negative and carries over to the next interaction, to be further strengthened or weakened. This carryover from one interaction to another is called sentiment and expresses itself as sentiment or even the enhancement or lowering of performance in channel functioning. So, sentiment results from the use of techniques and resources available to the influencer and is perceived by the influenced as the use of power to help guarantee his compliance in the relationship. These techniques and resources reside within the sociological mechanisms present in the dyadic interaction. What has been considered as classification schemes for power are in fact classification schemes for the use or absence of techniques and resources in the sociological mechanisms but perceived as power usage in the channels power literature. In this paper the focus is on the sociological mechanisms by which dyadic interaction proceeds and the power issues are viewed as natural, tangential and derived results of these mechanisms and dyadic interaction.

The Two Sociological Mechanisms by Which Channel Influence are Effected:

- 1.) Persuasion by Reference and,**
- 2.) Coping Tactics**

In this paper there are two sociological mechanisms which operate within dyadic interaction when the influencer has developed a marketing program and is attempting to gain compliance to its various facets in dealing with the distributor.

1.) Persuasion by Reference includes all of those motivations that a distributor feels that attract him or her to do business with the supplier in question. These can include an admiration for the business acumen and position of the supplier and its reputation for fair dealing, the view that the supplier has great expertise and specialized information in the manufacturing, distribution and promotion of products in its area of operation. It is also viewed as legitimate that this firm be granted the leadership role due to the characteristics above. This legitimacy can also stem from a contract existing between the supplier and distributor. This mechanism is based on a wish to be associated with a respected supplier and to associate with it. This mechanism is voluntary, less manipulative and operates in

the longer term. This longer term stems from the fact that this mechanism is rooted in motivations largely transcendent to the everyday effects of negotiations.

2.) Coping Tactics includes any instances where the influence recipient gains something valued or avoids an undesirable outcome. The supplier's marketing program can provide for a lower price, enter the buyer in a contest, or supply free goods for a larger purchase. Likewise, the program may offer these enticements but the distributor must make a larger purchase this year than last to qualify. In this case, the program is viewed as less rich as a larger purchase is necessary to qualify. This may be viewed as an undesirable outcome. This mechanism is imposed rather than voluntary, is therefore more manipulative and influences in a shorter term than Persuasion by Reference. This relatively shorter term results in the most recent episodes of negotiation exerting the most influence whereas in Persuasion by Reference the longer term is an artifact of its nature being transcendent over negotiation episodes.

Achrol's Scales of External Uncertainty to Measure these two Mechanisms

In *Organizations in Action*, J. D. Thompson (1967) (22) states that uncertainty is the fundamental problem faced by complex organizations and dealing with it is the central issue of the administrative process. He outlined three sources of uncertainty, the first one being **Generalized Uncertainty**, which is external to the organization and develops from a lack of understanding of the cause-and-effect relationships assumed to exist in the business environment. The second is **Contingency Uncertainty** which is also external and concerns the reactions of others in the environment to our organization's actions being unknown. With purpose and cause-and-effect understanding, contingency uncertainty causes interdependence with an unpredictable environment. The third source of uncertainty is **Internal Uncertainty** and arises from interdependencies within the organization and is thus internal to the organization. This type of uncertainty is not addressed here.

Thompson (1967) states that organizations are always dependent on other organizations for inputs and the influence of the environment on the organization operates through the perceptions of the decision makers in the dyad facing these dependencies. The development of dimensions of the environment from the political-economy paradigm and channels literature, has been influenced mainly by three researchers: Arndt (1983) [4], Achrol, Reve and Stern (1983) [3] and Achrol (1986b) [1]. Achrol suggested five dimensions: Capacity, Differentiation, Concentration/Dispersion and Turbulence. Achrol, Reve and Stern proceeded from a list of comprehensive and objective environmental variables and arrived at five variables: Environmental Capacity, Homogeneity-Heterogeneity (Simplicity-Complexity), Concentration-Dispersion, Stability-Instability and Turbulence.

Achrol (1986b) produced yet another comprehensive taxonomy of variables to give dimensions to the environment from the Organizational Behavior literature to scrutinize inter-organizational relations in channel operations. These appear in Table 2.

TABLE 2: ACHROL'S SEVEN DIMENSIONS AND THIRTEEN SCALES OF ENVIRONMENTAL UNCERTAINTY (ACHROL, 1986b)

1. CAPACITY:	Favorable/Unfavorable demand and supply situation during the last twelve months (1 scale),
2. DIVERSITY:	Similarity/diversity among customers and organizations dealt with (2 scales, customer & organizational),
3. INTERDEPENDENCE:	Degree to which input/output organizations and competitors tend to mimic each other or not (1 scale),
4. CONCENTRATION:	Degree of concentration of inputs/outputs in few/many organizations (1 scale),
5. DYNAMISM:	Degree of change in last twelve months (3 scales, in marketing practices, among competitors, & among customers),
6. INTERCONNECTEDNESS:	Degree of closeness of relationship with suppliers and customers (2 scales, input and output),
7. CONFLICT:	The level of competition among competitors vying for the market (3 scales, abnormal competition, unfair competition & threat).

Achrol and Stern (1988) [2] used Pfeffer and Salancik's 1978 [20] model on interaction in which Conflict and Interdependence were seen as mediating variables in a two-tier linkage of the model. The paper resulted in a rejection of the two-tier linkage and their suggestion that four dimensions be used in future channels research: Diversity among Consumers, Dynamism, Concentration and Capacity.

A questionnaire will be developed to measure uncertainty faced by the buyer in the channel dyad using the four environmental dimensions suggested by Achrol and Stern (1988) [2]. These will be related to the two sociological mechanisms through which it is here suggested dyadic negotiations works (Persuasion by Reference and Coping Tactics). The paper does not focus on power issues which are viewed as a resulting side issue of the interactions in the dyad and are an integral part of the subsequent perceptions and sentiment developing from this interaction in the minds of the dyad member influenced.

The Scales to Be Used

The following are the scales as used in this research. They are taken directly from the work of Achrol and Stern (1988) [2] and follow their suggestion that only four of the dimensions they employed be used. In this paper these writers described the operationalization of the constructs they used. These are reported below. There may be modifications necessary before employing them in the present work.

Operationalization of Constructs (Taken directly from Achrol and Stern (1988))

Environmental Diversity (DIV)

This was operationalized as two different constructs, 1.) diversity among individual consumers (DIV-C) and, 2.) diversity among organizational customers (DIV-O). In both cases, a t-point scale was used between very similar and very different.

DIV-C:

- demographic characteristics (income, profession, education, social class)
- preferred variety of product brands/features
- product preferences in price/quality
- credit needs

DIV –O:

- nature and size of business
- preferred variety of product brands/features
- product preferences in price/quality
- credit needs

Environmental Dynamism (DYN)

Operationalized as three derived constructs, 1.) dynamism in marketing practices (DYN-MP), 2.) competitor dynamism (DYN-CP), and, 3.) customer dynamism (DYN-CM). In all three subconstructs a 7-point scale was used between no change to very frequent change.

DYN-MP:

- changes in mix of products/brands carried
- changes in sales strategies
- changes in sales promotions /advertising strategies

DYN-CP:

- changes in competitor's mix of products and brands
- change in competitor's sales strategy
- changes in competitor's sales promotions/advertising strategy

DYN-CM:

- changes in customer's preference in product features
- changes in customer preferences in brands

- changes in customer preferences in product quality/price

Environmental Concentration (CONC)

Operationalized by 7-point scales measuring the relative concentration in the business environment.

CONC

- level of competitor domination
- amount of business resources enjoyed by the top four dealers in the market and a 10-category percentage scale measuring
- market share of top four dealers

Environmental Capacity (CAP)

Operationalized by 7-point scales anchored from very favorable to very unfavorable and measuring the following items.

CAP:

- potential for economic growth in the market area
- demand for products/brands of the focal supplier
- demand for the focal supplier's product category
- general consumer demand conditions for dealership

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Market Orientation and Business Performance: The Point of Diminishing Returns in Community Banks

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These are interesting days for bankers and their banks. Customers are demanding ever more at lesser cost. Competition is coming from all points on the financial services compass. Shareholders are seeking increased returns on their investment in bank equities. In addition, the financial regulators are demanding that capital be increased thus putting pressure to increase earnings. It is into this fray that the authors of this article journeyed to determine at what point customer orientation and being influenced by competitors detracted from the ability of a bank to maximize its profitability and thus meet the requirements and demands of the shareholders and the financial regulators.

Prior studies have shown an inconsistent relationship between market orientation and enhanced business performance. Numerous researchers have addressed this issue with mixed results. Research has shown an inconsistent relationship between market orientation and enhanced business performance. (Kohli & Jaworski, (1990, 1993); Narver & Slater, (1990, 1994; Desphande et al., 1993; Avlonitis & Gounaris, 1999, Chang & Chen, 1998; McNaughton et al., 2002) Some studies showed a slightly positive relationship between the two factors and levels of profitability, while other studies concluded there was no relationship. This has led the authors to conclude that perhaps

there was a point of diminishing returns when it came to customer orientation and concerns over competitive factors. To the knowledge of the authors, no research has been conducted to investigate at what point, if any, there is a diminishing return on an investment in market orientation. In the attempt to better understand the relationships between the factors of a customer and competitive orientations and profitability, the authors conducted a study of the community banking industry.

Problem and its Background

For the purposes of this study market orientation is defined by Narver and Slater (1990). From an extensive review of the literature, Narver and Slater (1990) inferred that there are three behavioral components and two decision criteria that comprise market orientation. The three behavioral components are customer orientation, competitor orientation and inter-functional discipline. The two decision criteria are long term focus and profitability. The authors define customer orientation as “the sufficient understanding of one’s target buyers to be able to create superior value for them continuously” (Narver& Slater, 1990, p. 21). Competitor orientation is defined as the “seller’s understanding of the short-term strengths and weaknesses and long-term capabilities and strategies of both the key current and key potential competitors” (Narver & Slater, 1990, p. 21). Inter-functional discipline is defined as “the coordinated utilization of company resources in creating superior value for target customers” (Narver & Slater, 1990, p. 22). This study examines the relationship between market orientation, its three behavioral components and enhanced business performance, as measured by return on assets in the community banking segment of the commercial banking industry.

The investigators looked at three behavioral components of customer orientation. These are; customer orientation, competitor orientation and inter-functional coordination.

Based on these components of customer orientation four hypotheses were develop.

H1 There is a positive and significant relationship between market orientation and return on assets.

H2 There is a positive and significant relationship between customer orientation and the return on assets.

H3 There is a positive and significant relationship between competitor orientation and the return on assets.

H4 There is a positive and significant relationship between inter-functional coordination and return on assets.

Population

The surveyed population consisted of CEOs of community banks in several southeastern states. The homogeneity of the sample was a plus in reducing the impact of extraneous factors. Also, the time frame selected for study precluded the current economic turmoil and was considered by the authors to be a period of normal economic activity.

Community banks and savings associations in Florida, Georgia, Tennessee, North Carolina and Virginia comprised the study population. A total of 926 institutions were selected from the directories published by the various state bankers' associations. There

were three selection criteria: 1) that the bank is not part of a super-regional or nation-wide bank holding company, 2) the bank is at least three years old, and 3) the bank needs to be profitable.

Questionnaire Design and Scaling

A self-administered twenty question survey instrument was utilized for the study. The questions used a scale of 1 to 7, where 1 represented "not at all" and 7 represented "to an extreme extent". Interviewees were asked a matrix of open ended questions about their respective banks total assets, total capital, and profit after taxes for a three year period. These figures were obtained or derived from audited financial reports filed with each of the bank's appropriate governmental regulators.

A total of 926 survey questionnaires were sent via US Postal Service first class mail with a cover letter and a stamped self-addressed return envelope. No compensation or inducement was offered to the survey participants. A total of 221 survey questionnaires were returned. Of the 221 questionnaires returned 40 lacked data and 19 were from banks that suffered financial losses during the time frame studied, which eliminated these questionnaires from the study. The remaining 162 usable questionnaires resulted in 17.5% response rate.

Analysis

Descriptive statistics and other statistics were analyzed, which comprised several steps. Strong linear correlations were found between market orientation and return on assets in the scale range surrounding 4.7.

Results

The results indicated that beyond a certain point, the investment in market orientation, and its three components yielded a negative return. This point was approximately 4.7 on a 7 point scale, which equated to a “more than moderate (4.0)”, but “less than considerable (5.0)” In summary, an investment beyond a "more than moderate level" yielded a negative return.

Analysis of Findings

The possible causes of decline in profitability as market orientation is enhanced are as follows:

Customer Orientation:

1. Excessive staffing levels required to provide an enhanced level of customer service.
2. Positive responses to customer’s request to waive fees for services provided or the charging of lower interest rates on extensions of credit.
3. Excessive advertising or hours of operation with their accompanying expense.

Competitor Orientation:

1. Heavy investment in branch and ATM networks in order to compete with large or less profit oriented institutions.

2. Responding to meet the competition from lower cost providers such as credit unions or banks that are market share oriented.
3. Inclusion of products in the bank's product line in which the bank has limited expertise and thus subjects itself to operational inefficiencies or credit losses.

Inter-functional Discipline:

1. Duplication of staff efforts as decisions are made between departments rather than granting the original customer contact point authority to address the issue in question in a more timely and cost efficient manner.
2. Excessive investment in technology and communication systems.

Conclusion and Managerial Implications

Bank management should understand the costs involved in its marketing orientation, which should lead toward improved financial performance. Utilizing the results of this study may assist in determining actions that will improve the return on assets while continuing to provide services to the customer and competing effectively.

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BUILDING A SUSTAINABLE PROCESS FOR ANALYZING EPA CONSTITUENT INPUT VIA SOCIAL NETWORKS

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ABSTRACT

Like other government organizations, the Environmental Protection Agency hopes to improve the effectiveness of its programs by utilizing inputs from constituents via social media. During this three-month exploratory study, inputs from three social channels (IdeaScale discussion forum, Greenversations blog, and email) were gathered, and the text content was analyzed. Quantitative and qualitative workload characteristics observed in this study were used to determine the impact on staff to process and respond to constituent input. Suggestions are presented for a sustainable process for increasing participation, and disseminating information from these channels to appropriate agency departments for action.

INTRODUCTION

After the presidential election in 2008, federal agencies in the United States were charged with increasing collaboration, participation, and transparency with citizens. An Open Government Directive published in December, 2009 by the director of the Office of Management and Budget set forth expectations for all federal agencies to take specific actions to implement the principles of transparency, participation, and collaboration. These specific actions include “providing a forum to share best practices on innovative ideas to promote participation and collaboration, including how to experiment with new technologies, take advantage of the expertise and insight of people both inside and outside the Federal Government.” [7]

In response to this directive, on April 7th, 2010, the Environmental Protection Agency (EPA) published its Open Government Plan 1.0 [6], detailing its initiatives aimed at improving collaboration with stakeholders (the public, non-governmental organizations and industry) and partners (federal agencies, states, and tribes). The objectives are to include more stakeholders, encourage two-way communication, improve the EPA decision-making process, and provide citizens with better information. They wish to measure the success of efforts to engage the public, looking at volume of participation and at the impact of participation on results delivered by the EPA.

Several collaborative Internet technologies have been in use by the EPA in the last year. Internet video press conferences and town hall meetings are posted at <http://epa.gov/multimedia/mm-video.htm> on the EPA web site, as well as on YouTube <http://www.youtube.com/usepagov>. Podcasts (audio recordings) are used to provide a unique way of sharing information with the public. The EPA issues podcasts in ongoing series as well as on a one-time basis. Twitter posts

are on <http://twitter.com/lisajackson> by Administrator Lisa Jackson and more generally on <http://twitter.com/epagov>. The EPA also maintains a Facebook presence and a blog called “Greenversations.” As an early adopter of the Internet, establishing the first EPA home page in 1994 at <http://www.epa.gov/>, the EPA provides online search tools to retrieve data from multiple data sources in an underlying data warehouse. Real Simple Syndication (RSS) feeds provide news, information and data to stakeholders. Mobile phone applications are being developed to push information such as human health advisories out to the public. [6]

In order to connect and respond to public inquiries, encourage public participation, and provide consistent service, internal staff working groups have been meeting regularly to organize processes across EPA departments. The EPA seeks public feedback via its social networking channels on ways the agency can increase openness and transparency. The EPA posts questions to prompt constituent suggestions on how the EPA Open Government Plan 1.0 can be improved, what added data and information constituents wish to see, and what innovative uses of EPA data have been implemented.

To this end, the EPA Office of Environmental Information hired a summer intern from the Robins School of Business at the University of Richmond, to conduct a preliminary study of constituent inputs coming from new participatory outlets. The three new outlets were: IdeaScale (the discussion forum on the Open Government Initiative), the Open Government Email Box, and the “Greenversations” blog. The end results expected during the internship were:

- 1) analyze public commentary on these outlets, by category and responsible department,
- 2) provide suggestions for improving the three new outlets and project impact on staffing and computer technologies, and
- 3) design an effective process to handle inputs and responses in a manner sustainable under current staffing levels.

Although the duration of the internship was two months, inputs primarily from April 7 to July 15, 2010 were analyzed, for a total of about three and one-half months.

LITERATURE REVIEW

A literature review was conducted to find other studies of workloads coming from social networking channels in a public sector, corporate, or non-profit organization. In 2000, Williams and Cothrel [9] reported on an early, major study of 15 organizations by Arthur Andersen’s Next Generation Research Group, to determine best practices for managing online communities. The organization in this study most similar to the EPA in structure and incentives for online member participation was Kaiser Permanente, which not only wished to provide member services more conveniently online, but also wished to help members take charge of their own health-care decisions. The success of this online community was felt to be due to the assignment of a moderator, often with a background in health education and specific skills in moderation, to each discussion group. Moderator guidelines were: (1) clarify but don’t edit or police; (2) stimulate the conversation; (3) put members at center stage promoting peer support; (4) let members vent as a valuable way for the moderator to measure member satisfaction. Other organizations in this

study excelling at online communities included About.com, who provided exceptional moderator training and support, and Sun Microsystems and Ford, who provided strong knowledge management platforms for organizing internal information for moderators and participants.

A later study by Bross, Sack, and Meinel [3] tracked constituent behaviors over time on a blog combining information and communication technology (ICT) industry and business experts with top German government officials to support the development not only of a top-notch “think tank” but also a world-class ICT center in Potsdam. The researchers found that the role of the moderator was essential to sustained involvement of constituents on the blog, again assigning to each major topic a strong moderator who likely had an education and moderator background (possibly journalism – with a vested interest in periodically adding new “discussion-triggers” to stimulate responses on the blog). The researchers noted other factors important to the success of the online community:

- (1) offline interactions supplementing online interactions, like meetings and events;
- (2) a cost-saving and intuitive blogging platform for interaction;
- (3) publication of highly useful information, supplemented with new media like podcasts, video, and RSS feeds;
- (4) enlistment of other experts to provide opinions to the blog on related topics in politics, economics, and research.

Bross et al observed a drop in traffic on the blog after the first two months (although this also coincided with the summer, perhaps a seasonal effect as well as a behavioral effect). They monitored usage statistics, obtained external media support, and added discussion triggers to raise traffic to the site. They also improved the structure and convenience of the portal page as they gained experience in the blogging platform and knowledge of their audience.

The use of social networking outlets to support crisis management by government and corporate organizations is reviewed in Crandall and Ziemnowicz [4]. The capability during a crisis to communicate news that is not available on traditional media outlets, or to use outlets like Facebook or bloggers on outside servers, allows (indeed forces) rapid mobilization and response. Crandall and Ziemnowicz give examples of cases including the flawed Pentium chip, the Kryptonite bicycle lock problem, the Dominoes YouTube incident, and others.

Although the current data inputs in the EPA study below are relatively low-volume and low-complexity at the present time, more sophisticated technological solutions are being developed for analyzing massive amounts of unstructured text data, long strings of characters without a controlled vocabulary, like that found in social media. For many organizations, structured data in enterprise databases comprise only a small percentage of the information important to operations and strategy. Text analytics refers to a range of techniques like natural language processing, text mining, classification and tagging, visualization, etc. used in cases where less precision is acceptable. Software used to analyze unstructured text in large data sets of customer survey data can deliver information on patterns and trends in a short time [8].

In “Opinion Mining of Social Website Data,” Bose provides a survey of the use of data and text mining, separately and in combination, to make opinion mining possible [2]. Opinion mining is

concerned not only with the topic or facts in a document, but also with the subjective opinion expressed. This is also known as “sentiment analysis,” further described in Deshpande and Sarkar [5], who explain the steps required to extract sentiment information from text analysis. They provide sample applications for product reviews and the analysis of online discussion data from political campaigns/elections by geographical region.

Finally, Agichtein et al [1] present a model for measuring the quality of user-generated content (both questions and answers on the Yahoo! Answers social site). They measure "quality" of postings as measured by semantic features of the text, relationships between users and items posted, and usage statistics like number of clicks and dwell time on a page. They describe the voting capability of Yahoo! Answers allowing users to vote for answers of other users, mark interesting questions, and report negative behavior. Their research focuses on the evaluation of semantic features of text (punctuation and typos, syntactic complexity, and grammaticality). Their dataset is large (6,665 questions and 8,366 question/answer pairs), and their model classifies high quality questions and answers.

METHODOLOGY

In the summer of 2010, the student intern completed a nine-week internship for the EPA. She worked in the Office of Environmental Information (OEI), which is composed of the departments of Enterprise Information Technology and Open Government. The intern's role was to analyze the public commentary from the three newest social outlets: the IdeaScale discussion forum, the Open Government Email Box, and the Greenversations blog. She was charged to provide suggestions of how these three new outlets could be improved, and to help create an effective process by which the EPA can benefit from, and respond to, the public commentary.

The timeline for the internship called for a progress report on the Open Government Plan by June 25th, 2010, and a presentation proposing a design for the EPA response process by July 15th, 2010.

IdeaScale Discussion Forum

IdeaScale (<http://www.openepa.ideascale.com/>) is an online discussion forum tool which allows users to post suggestions on the Open Government Initiative, which are voted on by the public. (For more information on this web application and data collection capabilities, see the vendor site <http://ideascale.com/>.) The balance of the votes is posted, rather than the individual numbers of who agreed and the number of who disagreed (this function has been controversial among users). The EPA can moderate which comments and suggestions are posted publicly in order to filter out inappropriate dialogue. During this study, users could comment on six different categories regarding open government:

- Transparency
- Participation
- Collaboration
- Innovation

- Help Us Improve This Dialogue Site
- Innovative Uses of EPA Data

The student intern analyzed all comments submitted to IdeaScale between April and July, 2010. All comments were placed in an Excel spreadsheet, and each comment was described by other fields including Vote, Subject (provided by each user), Suggestion, Comment Number, and Program Office assigned to follow up with a response to the constituent. The Program Office assigned to writing a response to the submitter was one, or infrequently a combination, of the following:

- Office of the Administrator
- Office of Administration and Resources Management
- Office of Air and Radiation
- Office of Chemical Safety and Pollution Prevention
- Office of Enforcement and Compliance Assurance
- Office of Environmental Information
- Office of General Counsel
- Office of Water
- Office of International and Tribal Affairs

Each IdeaScale comment was then categorized by specific subject matter to gain insight into what topics were most cared about in the public (during this study, over 30% of the comments on IdeaScale pertained to the BP Oil Spill). Each constituent suggestion was assigned to one of 11 categories:

- Communication & Outreach
- Local Concerns
- Tools
- Transparency
- Policy & Regulation
- Data Information
- Administrative
- Specific Environmental Issues
- B.P. Oil Spill
- Off-Topic
- Collaboration

In order to create additional queries on this data, the data also was imported into a Microsoft Access database, in which each comment was described with controlled fields for category as well as the program office assigned to respond to the comment. These fields provided structured text to supplement the unstructured memo fields in the Subject line provided by the constituent and the free-text Suggestion field.

Open Government Email Box

The Open Government Email Box was an email account where users could submit comments on open government. The Open Government Email Box was intended to be an outlet so that users would have a more private option of submitting questions or suggestions regarding open government, compared to the blog and the discussion forum. Users could submit an email by clicking the "Contact Us" link provided on the EPA's Open Government web page, which would link them to a comment form template. Users received a direct email back from an EPA Open Government employee. Users' comments and user name remained private (unlike IdeaScale and Greenversations). The student intern reviewed the text of emails submitted during this time period.

Greenversations Blog

Greenversations (<http://blog.epa.gov/blog/>) is the EPA's blog which posts opinions, news, regulations, and research. Users can comment on the Open Government Plan by section within the April 7th, 2010 plan document and on their goals. Users can learn about current events and new regulations. Users can currently read and comment on the EPA's current posting, such as "August is Cataract Awareness Month...Learn How to Protect Your Eyes." The student intern reviewed all blog posts during this time period.

RESULTS

The public comments in the two of the three new participatory outlets had formatting and functionality problems during this exploratory period. The volume of inputs received through these outlets during the study period of three and one-half months is indicated below, along with recommendations for modifications by the intern and her work team.

IdeaScale Discussion Forum

There were a total of 326 suggestions during this study. About 40% of these comments were made by first-time users versus 60% from returning users, but very few users posted more than two comments. During the study period, IdeaScale was being used as an outlet for the public to comment on a variety of environmental issues, rather than on open government. The breakdown of the comments by category was as follows:

Pareto Analysis of IdeaScale Suggestions by Idea Category

<u>Category</u>	<u>Count</u>	<u>%</u>	<u>Cumulative %</u>
BP Oil Spill	86	0.32	0.32
Transparency	43	0.16	0.47
Communication & Outreach	29	0.11	0.58
Tools	24	0.09	0.67
Policy & Regulation	23	0.08	0.75
Data Information	17	0.06	0.82
Specific Environmental Issues	16	0.06	0.88
Administrative	13	0.05	0.92
Off-Topic	11	0.04	0.96
Collaboration	8	0.03	0.99
Local Concern	2	0.01	1.00
Total Count	272		

Analysis of the IdeaScale suggestions by Program Office indicated the number of comments NOT about open government:

Pareto Analysis of IdeaScale Suggestions by Program Office

<u>Program Office</u>	<u>Count</u>	<u>%</u>	<u>Cumulative %</u>
Not Applicable (About BP Oil Spill, Not Open Govt)	97	0.36	0.36
Unknown	52	0.19	0.55
OEI - Office of Environmental Information, OEI/OARM	28	0.10	0.65
Open - Open Government Steering Committee, Open/OEI, Open/OPA, Open/FOIA	25	0.09	0.74
OARM - Office of Admin. & Resources Management	21	0.08	0.82
OECA - Office of Enforcement & Compliance Assurance, OECA/OCFO, OECA/OSWER	15	0.06	0.88
Not Assigned/Blank	9	0.03	0.91
OA - Office of the Administrator	4	0.01	0.92
OPA - Office of Public Affairs	4	0.01	0.94
OCSP - Office of Chemical Safety & Pollution Prevention	3	0.01	0.95
OW - Office of Water	3	0.01	0.96
OAR - Office of Air and Radiation	3	0.01	0.97
OSWER - Office of Solid Waste and Emergency Response	3	0.01	0.98
FOIA - Freedom of Information Act	2	0.01	0.99
OGC - Office of General Counsel	1	0.00	0.99
Tribal - Office of International and Tribal Affairs	1	0.00	1.00
OCFO	1	0.00	1.00
Total Count	272		

Toward the end of the study period in July, 2010, the rate of incoming comments was down to approximately five comments per week on average. The team recommended closing the six current topics on the discussion forum. Their recommendation was to implement instead a single topic, or just a few topics for suggestions from constituents, changing each quarter, to help comments stay on-topic and be more actionable. In the next period, topics will be focused around open government, but will not be as broad as before.

Currently, on the EPA's IdeaScale web page, <http://openepa.ideascale.com/a/panel.do>, there are three current topics specifically on open government, although there does not appear to be much current participation. Statistics indicate there are over 1100 registered users for this IdeaScale site. The public also can view spreadsheet archives from the six topics in use during the data collection for this study, including data from February through July. It is possible that heightened attention to Open Government after the publication of the Open Government Directive in December, 2009, and also to the environment during the BP oil spill, resulted in much more traffic to the EPA web site and more participation in IdeaScale. Bross et al [3] and Williams and Cothrel [9] strongly suggest that 1) a trained moderator for each topic and 2) continual updating of topics and intentional incentives to draw users to discussion or blog sites are necessary for sustained activity on these social channels.

Open Government Email Box

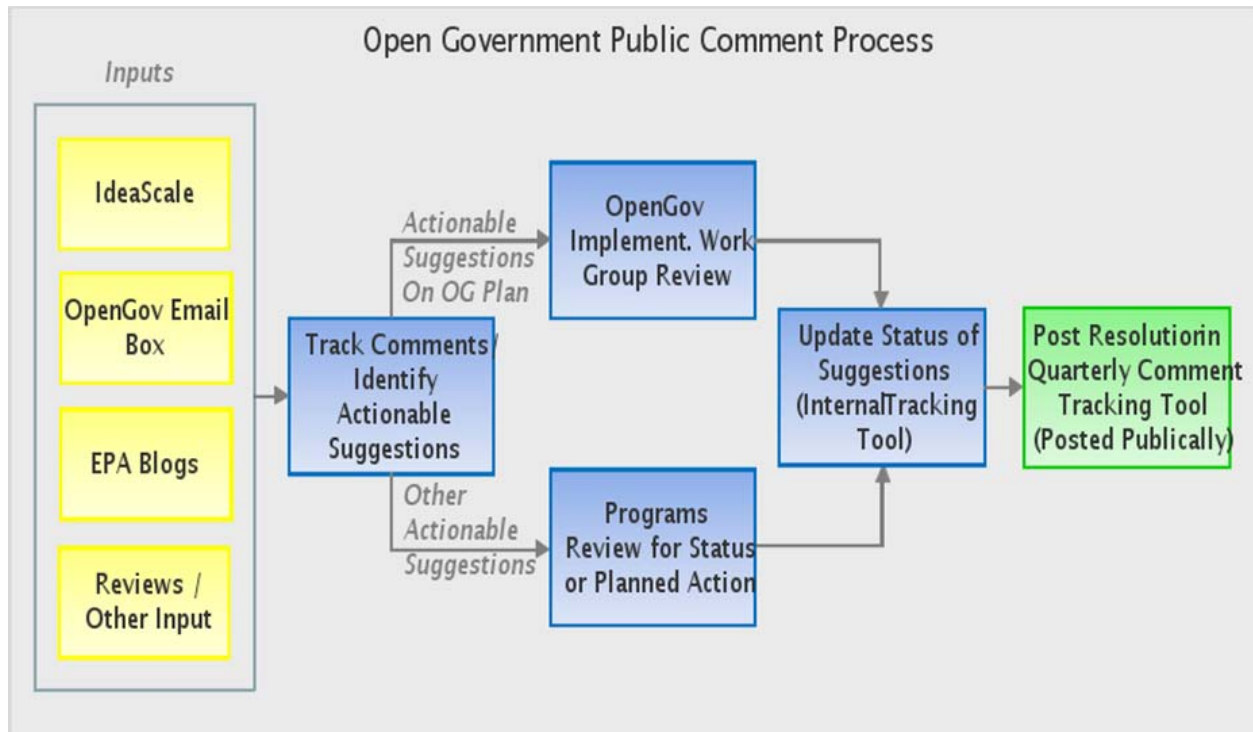
There were a total of 445 emails total during this study. However, because the Open Government Email Box contained many off-topic or EPA-wide comments as well as spam during the study period, the team recommended that the Open Government email box be eliminated. In its stead, the team recommended that the epa.gov home page "Contact Us" function be used for all email suggestions. The Open Government office did not have the staffing available to successfully read and respond to all of the emails coming in, and it was counterproductive to have multiple email boxes. The greater EPA administration does have more staffing to respond to public emails that come in, so it would be a more efficient use of employee time if there was just one channel for EPA emails. When an email comes in regarding open government, it is forwarded on to the appropriate team member in the Open Government department.

Greenversations Blog

There were 17 comments on the open government posting total during this study. No changes were suggested. The blog holds a minimal amount of commentary, which is moderated and appropriate subject matter.

Recommendations for Responding to Comments

The team recommended a process for responding to actionable suggestions coming from IdeaScale, the email box, and the "Greenversations" blog.



Whether or not a suggestion is “actionable” depends on reading and interpretation, along with any added input from users voting on others’ suggestions (suggesting common opinions). The Open Government Work Group (leaders across the agency) felt that every comment submitted should receive some form of individual response, and the nature of the comments received during this study indicate that these responses will require expertise from the pertinent program office(s).

At the close of each quarter, a topic on IdeaScale will close, and the actionable programmatic suggestions will be forwarded to the appropriate office for evaluation. At the end of the each quarter, the status of each comment (in process, completed, or not actionable) must be published in a public location, as required by the Open Government Directive and the Office of Management and Budget (OMB). IdeaScale does allow a moderator appointed from each programmatic office to respond directly and publicly to a posted suggestion, potentially shortening the elapsed time for a response.

CONCLUSION

Organization and clarity in the design of social networking channels are important to the effectiveness and sustainability of processes using these tools to obtain inputs from constituents in high volumes. Improvements have been made that will allow the EPA to improve their decision-making skills and overall communication with the public. The distribution of constituent comments to each program office is a crucial step in the proposal for the response process. Without the collaboration from these offices, the responses given back to the public would end up coming from a less informed source, and without a quick response.

This process is the start of an effective and sustainable treatment of constituents' inputs through social networking channels. Attention should be paid to the moderator role: staffing and training, and directing traffic to the blog and discussion forum by coordinating with EPA events like town hall meetings and activities on the other social sites.

One measure of success will be an increase in the number of comments per month, necessitating updates to the review and response process, technology support, and staffing. Ultimately, the EPA's programmatic success also will be a result of their interdepartmental transparency, collaboration, and participatory opportunities for its external constituents.

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**A COMPARISON OF WELCOME CENTER AND AREA ATTRACTION VISITORS:
DIFFERENCES IN THE BLUE RIDGE NATIONAL HERITAGE AREA**

by

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ABSTRACT

This article compares visitors to welcome centers and attractions in the Blue Ridge National Heritage Area of North Carolina in terms of their area awareness, respondent and travel party demographics, and expenditures. The differences between overnight visitors, day trippers and those just passing through are also analyzed. Significant differences were found between the groups, lending credibility to the notion that data collected at welcome centers is not generalizable to area attractions.

Much work has been conducted examining the generalizability of results obtained from travelers to welcome centers versus travelers in other contexts. The results from this work are mixed, some of the research supports welcome center data generalizability while other research does not. This paper explores the issue of welcome center sampling frame generalizability. First, the literature in the area is presented. This is followed by an explanation of the research method and presentation of results. The paper concludes with a discussion of the results.

LITERATURE REVIEW

In travel and tourism research, questions are often raised about whether data collected from visitors to welcome centers are representative of visitors in other contexts, such as going to attractions (i.e., whether the results are generalizable). Some of the work addressing this question seemed to suggest that results obtained from surveys collected at welcome centers were an accepted research method and represented a larger sampling frame than simply those stopping at rest areas. For example, Gitelson and Crompton (1983) reported collecting data for their study from two Texas Highway Visitor Centers. In their limitations section they noted that the generalizability of their findings was "...not determinable (p. 7)", suggesting that the results may or may not be generalizable to all pleasure vacationers (see manuscript title). Further evidence supporting the reliance on data collected at welcome centers as representative of visitors in general was provided by Howard and Gitelson (1989). Their study compared survey results from eight port-of-entry (state line) welcome centers to three of the state's major attractions. No differences between the two groups were found for age, income, travel party size, number of nights planned, lodging, first trip to the state or whether the state was the primary destination.

Fodness and Murray (1997, 1999) published two articles purporting to match Florida Department of Commerce Division of Tourism data with data that they collected using a sampling frame of visitors to official Florida Welcome Centers. Although no statistics of the match were reported in either paper, the authors concluded that the match was "...quite good in terms of demographic and behavioral characteristics...(p. 509)." Citing Howard and Gitelson's (1989) work the authors closed the issue by stating that "Previous research from other states has documented the lack of significant differences between out-of-state tourists who use welcome centers and those who do not (Fodness and Murray 1997, p. 509)."

Several studies have reported the opposite results. Muha (1977) compared welcome center visitors (first-time welcome center visitors and repeat welcome center visitors) to non-welcome center visitors on age, travel party size, family income, and trip purpose, among others. He found that welcome center visitors tended to be older, had larger travel party sizes, higher incomes, and were more likely to be traveling for pleasure or to visit friends and relatives than non-welcome center visitors.

Using license plate information obtained from interstate travelers in Texas, Stewart et al. (1993) found significant differences between stoppers (at two state welcome centers) and nonstoppers with respect to point of origin, age, miles driven, trip planning horizon, purpose of the trip, and trip expenditures. Finally, in a study exploring differences between state welcome center users and local visitor center users in Louisiana, Dimanche and Taylor (2006) found significant differences in trip duration, lodging (campgrounds and B & Bs but not hotels and motels), trip

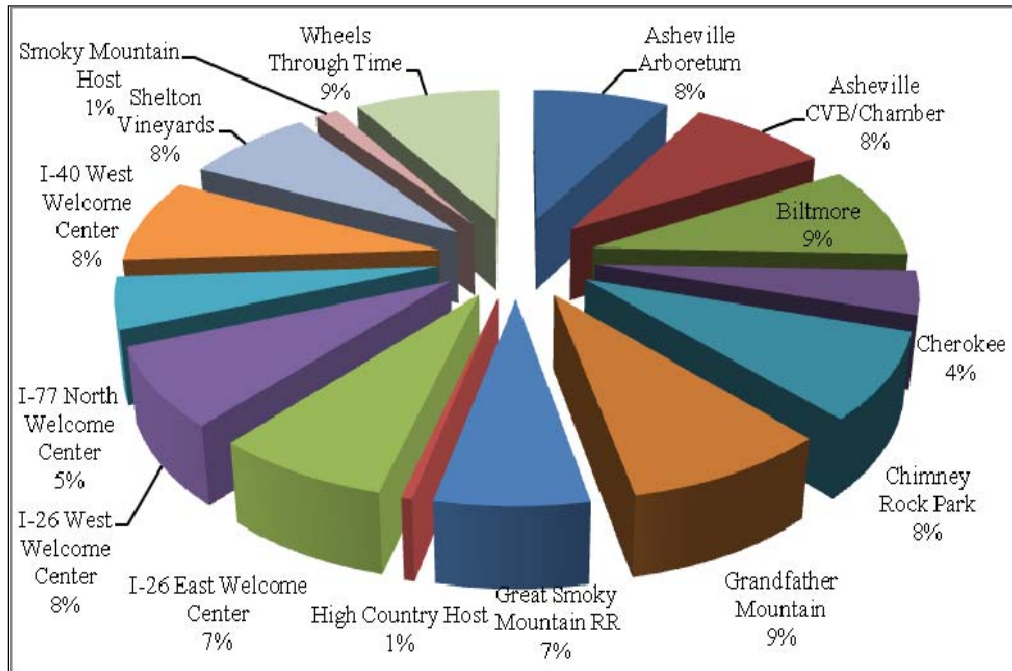
activities other than shopping, attending a sporting event or visiting an art gallery, and information source use.

Based on the aforementioned research it appears that the jury is still out regarding the question of the generalizability of data obtained from welcome centers. The current study is intended to contribute to the existing literature in two ways. First, the research will explore the issue of generalizability of data collected at welcome centers (both state and local centers) located in the Blue Ridge National Heritage Area (Western North Carolina) by comparing respondent area awareness, travel party demographics and spending with data collected from respondents at area attractions. Second, the data will be partitioned into overnight visitors, day trippers and those travelers just passing through to see whether differences are found between welcome center respondents and respondents at area attractions within each of these groups.

RESEARCH METHOD

The data used in the study were collected from 15 tourism partners in the Blue Ridge National Heritage Area located in the western part of North Carolina (see Figure 1). The data was collected during the late summer and fall of 2006 from 15 data collection sites, 7 welcome centers (local and state) and 8 area attractions. In all, 4,713 surveys were collected. Of the 4,713 respondents, 850 (19.04%) identified themselves as *day trippers*, 3,462 (71.98%) were *overnight visitors* and 401 (8.98%) indicated that they were *just passing through*.

FIGURE 1
Venues of Data Collection



Several respondent and travel party demographic variables were measured. These included respondent age, gender, education and income, travel party size and number of people in the travel party under the age of 18. Awareness of the Blue Ridge National Heritage Area was measured using a 5 point Likert scale. Finally, travel party spending on nine expense categories was measured. The following sections describe the results obtained from the data analysis.

RESULTS

The results are divided into four sections. The first section discusses differences between welcome center visitors and visitors to area attractions across the entire sample (i.e., combined sample differences). The following three sections divide the sample into three visitor types, overnight visitors, day trippers, and those just passing through and tests for differences between welcome center visitors and area attraction visitors within each visitor type.

Combined Sample Differences

As Tables 1A and 1B show, of the seventeen variables tested, seven show significant differences (number of people in the travel party, spending on food, spending on tours and admissions, age, gender, education, and income). Although other spending was marginally significant, the results were interpreted as being statistically different if the level of significance fell below .05 since the sample size was so large.

As Table 1A shows, the average travel party size was larger for visitors to attractions than visitors to welcome centers. Attraction visitors reported spending more on food and tours and admissions than welcome center respondents. Attraction visitors were younger than those surveyed at welcome centers. Finally, as Table 1B shows, a larger proportion of females (and a corresponding smaller proportion of males) were surveyed at welcome centers than at attractions, and attraction visitors reported higher levels of both education and income.

To control for visitor type, within visitor-type analyses were also conducted. Tables 2A and 2B present the analyses for overnight visitors.

Overnight Visitors

Table 2A shows the results of a statistical test for the difference between the means for overnight visitors surveyed at welcome centers versus those surveyed at area attractions. For overnight visitors, differences between respondents surveyed at welcome centers and area attractions were found for number of people in the travel party, spending on food, spending on tours and admissions, age, gender and income. Specifically, overnight visitors surveyed at attractions

TABLE 1A						
Overall Tests For Mean Differences Between Welcome Center and Attraction Respondents Interval or Ratio Scaled Variables						
	Venue	N	Mean	Std. Deviation	t	Sig. (2 -Tailed)
Awareness of BRNHA	WC ¹	1667	2.8902	1.6242	1.46	.1444
	ATT ²	2683	2.9646	1.6486		
# People in Travel Party	WC	1795	2.6345	1.3142	8.24	.0001
	ATT	2714	2.9908	1.5699		
# People < 18 in Travel Party	WC	1695	.3493	.7885	.16	.8714
	ATT	2581	.3534	.8366		
\$ Spent on Food	WC	1448	153.69	174.27	5.23	.0001
	ATT	2457	190.88	270.12		
\$ Spent on Transportation	WC	1448	84.41	114.3	.46	.6482
	ATT	2457	82.645	120.73		
\$ Spent on Accommodation	WC	1448	217.17	325.14	.77	.4417
	ATT	2457	226.15	394.01		
\$ Spent on Arts and Crafts	WC	1448	60.218	119.81	.52	.6014
	ATT	2457	57.861	160.14		
\$ Spent on Music Activities	WC	1448	18.785	52.871	1.50	.1345
	ATT	2457	16.171	52.442		
\$ Spent on Tours and Admissions	WC	1448	48.977	69.205	7.42	.0001
	ATT	2457	68.505	94.226		
\$ Spent on Outdoor Activities	WC	1447	17.628	80.228	.36	.7224
	ATT	2457	16.779	55.777		
\$ Spent on Clothes	WC	1448	29.885	72.564	.73	.4681
	ATT	2457	31.846	94.925		
\$ Other	WC	1448	15.587	77.466	1.75	.0809
	ATT	2457	24.174	221.93		
Age	WC	1452	53.7	14.233	8.56	.0001
	ATT	2366	49.611	14.489		

¹WC = Welcome center visitors

²ATT = Area attraction visitors

TABLE 1B			
Overall Goodness-of-Fit Tests for Differences Between Welcome Center and Attraction Respondents For Categorical Variables			
	χ^2	df	Significance
Gender	12.8598	1	.0003
Education	13.8049	3	.0032
Income	31.3990	7	.0001

reported more people in their travel party, greater spending on food as well as tours and admissions. In addition, there was a higher proportion of females (and a corresponding lower proportion of males) surveyed at welcome centers than at attractions (Table 2B). Finally, attraction respondents reported higher income than welcome center respondents.

Day Trippers

Table 3A shows the results of a statistical test for the difference between the means for day trippers surveyed at welcome centers versus those surveyed at area attractions. Differences between respondents surveyed at welcome centers and area attractions were found for number of people in the travel party, Spending on food, spending on arts and crafts, spending on tours and admissions, spending on outdoor activities, age, and gender. Specifically, day trippers surveyed at area attractions reported a larger travel party, more spending on food, less spending on arts and crafts, greater spending on and tours and admissions as well as outdoor activities. Attraction visitors also reported being younger than those at surveyed at welcome centers.

Table 3B shows that respondent gender also varied as a result of where they were surveyed. Specifically, a welcome centers had a higher proportion of females (and a lower proportion of males) than attraction respondents.

Just Passing Through

Table 4A shows the results of a statistical test for the difference between the means for those just passing through surveyed at welcome centers versus those surveyed at area attractions. For those just passing through, differences between respondents surveyed at welcome centers and area

attractions were found for spending on tours and admissions and age. Specifically, area attraction respondents reported spending more on tours and admissions and were also younger than those surveyed at welcome centers. It should be noted that spending on food, outdoor activities, and other spending were marginally significant yet did not reach significance probably due to the much smaller sample size than the other visitor types.

	Venue	N	Mean	Std. Deviation	t	Sig. (2 -Tailed)
Awareness of BRNHA	WC	1118	2.9794	1.6197	.37	.7077
	ATT	1834	3.0027	1.6662		
# People in Travel Party	WC	1214	2.659	1.3242	6.17	.0001
	ATT	1876	2.959	1.5588		
# People < 18 in Travel Party	WC	1148	.3345	.7876	.17	.8667
	ATT	1773	.3294	.8276		
\$ Spent on Food	WC	1051	194.43	185.97	5.05	.0001
	ATT	1747	240.19	293.29		
\$ Spent on Transportation	WC	1051	101.67	123.82	.02	.9804
	ATT	1747	101.79	130.79		
\$ Spent on Accommodation	WC	1051	296.13	349.05	1.20	.2308
	ATT	1747	314.06	433.98		
\$ Spent on Arts and Crafts	WC	1051	75.07	133.93	.60	.5480
	ATT	1747	71.466	181.80		
\$ Spent on Music Activities	WC	1051	24.348	58.973	1.85	.0642
	ATT	1747	20.11	58.074		
\$ Spent on Tours and Admissions	WC	1051	62.746	74.198	5.92	.0001
	ATT	1747	82.677	103.11		
\$ Spent on Outdoor Activities	WC	1050	23.582	93.324	.94	.3497
	ATT	1747	20.543	62.685		
\$ Spent on Clothes	WC	1051	35.283	77.717	.72	.4715
	ATT	1747	37.643	93.414		
\$ Other	WC	1051	18.166	85.385	1.71	.0869
	ATT	1747	29.799	261.72		
Age	WC	1001	55.158	13.46	7.93	.0001
	ATT	1622	50.824	13.808		

TABLE 2B
Overnight Visitor Goodness-of-Fit Tests for Differences Between Welcome Center and
Attraction Respondents For Categorical Variables

	χ^2	df	Significance
Gender	7.4617	1	.0063
Education	7.5550	3	.0562
Income	26.0047	7	.0005

TABLE 3A
Day Tripper Tests For Mean Differences Between Welcome Center and
Attraction Respondents Interval or Ratio Scaled Variables

	Venue	N	Mean	Std. Deviation	t	Sig. (2 -Tailed)
Awareness of BRNHA	WC	216	2.889	1.633	.26	.7948
	ATT	580	2.8552	1.6041		
# People in Travel Party	WC	231	2.5281	1.1374	6.21	.0001
	ATT	571	3.1576	1.6361		
# People < 18 in Travel Party	WC	217	.3272	.7257	1.70	.0893
	ATT	551	.4319	.7647		
\$ Spent on Food	WC	173	47.191	38.865	2.25	.0246
	ATT	514	59.695	106.56		
\$ Spent on Transportation	WC	173	30.168	25.781	.09	.9272
	ATT	514	30.479	63.017		
\$ Spent on Accommodation	WC	N/A	N/A	N/A	N/A	N/A
	ATT	N/A	N/A	N/A		
\$ Spent on Arts and Crafts	WC	173	29.636	58.348	2.16	.0313
	ATT	514	18.938	49.415		
\$ Spent on Music Activities	WC	173	2.7746	13.011	.80	.4269
	ATT	514	3.7646	17.128		
\$ Spent on Tours and Admissions	WC	173	17.595	31.06	4.50	.0001
	ATT	514	32.298	51.274		
\$ Spent on Outdoor Activities	WC	173	1.7861	7.0789	3.46	.0006
	ATT	514	5.4377	20.549		
\$ Spent on Clothes	WC	173	17.688	52.895	1.53	.1269
	ATT	514	10.856	43.751		
\$ Other	WC	173	11.04	56.71	.44	.6624
	ATT	514	9.0311	36.078		
Age	WC	173	49.058	14.741	2.40	.0167
	ATT	514	45.907	15.004		

TABLE 3B			
Day Tripper Goodness-of-Fit Tests for Differences Between Welcome Center and Attraction Respondents For Categorical Variables			
	χ^2	df	Significance
Gender	6.1207	1	.0134
Education	5.8933	3	.1169
Income	5.6678	7	.5790

Table 4B also shows that gender varied with survey location. As with the overall sample and the other sub-samples, a larger proportion of females (and a corresponding smaller proportion of males) were surveyed at welcome centers than at area attractions.

DISCUSSION

Across and within visitor type, differences were found in crucial respondent and travel party demographic and spending measures, although the differences tapered off for visitors that were just passing through (probably due to a smaller sample size). Across visitor types, visitors to area attractions reported larger travel parties, spending more on food, and spending more on tours and admissions than visitors to welcome centers. The respondents at area attractions were younger, included a larger proportion of males and attraction visitors reported higher levels of both education and income.

The results for overnight visitors largely emulated those of the sample as a whole with the exception that respondent educational attainment level between area attraction visitors and welcome center visitors fell to marginal significance. A similar pattern of spending appeared for day tripper visitors as that of the overall (combined) sample except day trippers at welcome centers reported spending more on arts and crafts than their area attraction counterparts and that

TABLE 4A						
Passing Through Tests For Mean Differences Between Welcome Center and Attraction Respondents Interval or Ratio Scaled Variables						
	Venue	N	Mean	Std. Deviation	t	Sig. (2 -Tailed)
Awareness of BRNHA	WC	255	2.6471	1.6171	.89	.3753
	ATT	122	2.8033	1.5884		
# People in Travel Party	WC	269	2.684	1.3661	1.36	.1746
	ATT	121	2.9174	1.6461		
# People < 18 in Travel Party	WC	258	.4225	.8298	.82	.4154
	ATT	118	.3559	.6859		
\$ Spent on Food	WC	169	35.888	46.577	1.78	.0791
	ATT	89	76.596	213.63		
\$ Spent on Transportation	WC	169	39.503	50.677	.92	.3575
	ATT	89	34.124	40.936		
\$ Spent on Accommodation	WC	N/A	N/A	N/A	N/A	N/A
	ATT	N/A	N/A	N/A		
\$ Spent on Arts and Crafts	WC	169	9.213	32.907	1.25	.2152
	ATT	89	19.551	74.486		
\$ Spent on Music Activities	WC	169	3.2544	15.219	.86	.3895
	ATT	89	5.5506	22.526		
\$ Spent on Tours and Admissions	WC	169	7.2485	30.657	4.46	.0001
	ATT	89	28.798	39.814		
\$ Spent on Outdoor Activities	WC	169	1.8047	11.067	1.66	.0991
	ATT	89	5.2697	17.959		
\$ Spent on Clothes	WC	169	9.0888	30.857	.46	.6429
	ATT	89	11.775	49.723		
\$ Other	WC	169	3.9231	20.396	1.71	.0898
	ATT	89	14.045	53.749		
Age	WC	219	50.626	15.832	2.75	.0065
	ATT	108	45.417	16.256		

TABLE 4B			
Passing Through Goodness-of-Fit Tests for Differences Between Welcome Center and Attraction Respondents For Categorical Variables			
	χ^2	df	Significance
Gender	7.7188	1	.0055
Education	7.0849	3	.0692
Income	9.1122	7	.2447

area attraction day trippers reported spending more on outdoor activities. Demographically, the results were similar to the combined sample for respondent gender and age, but not education and income. Finally, compared to the combined sample results, those attraction visitors just passing through reported spending more on tours and admissions than just passing through welcome center visitors. Again, demographically the results were similar to the combined sample with respect to gender and age, but not education and income.

Overall, the differences found in this research suggest that conclusions drawn from data collected from visitors to welcome centers are not generalizable to area attraction visitors. This point is not mundane. Consider a researcher attempting to quantify the economic impact of tourism to an area using a survey to elicit visitor spending. Results of this study suggest that the venue of data collection may very well have an effect on the results obtained. Unfortunately, as with many other research endeavors, it seems that data has to be collected the hard way (at area attractions rather than at welcome centers) to insure sampling frame compatibility and therefore generalizability of results.

The results of this research comport with those of Muha (1977), Stewart et al. (1993), and Dimanche and Taylor (2006) and directly contradict those of Howard and Gitelson (1989). Further work needs to be conducted comparing results obtained between welcome centers and area attractions, state welcome centers and local welcome centers and between interstate welcome centers themselves to clarify the question of generalizability.

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Tourism Research: A Neural Network and Cluster Analysis Approach

Abstract

The authors present a unique way of analyzing and interpreting tourist data using backward propagation neural networks in conjunction with cluster analysis. The results are analyzed using a survey of 1,271 respondents.

Introduction

The tourism industry continues to attract attention in the literature. Several states such as New York, South Carolina, California, Nevada, and Florida have significant revenue streams tied to the industry. The industry impacts reservations at hotels, traffic at restaurants, attendance at museums and malls, number of car rentals, and sales of thousands of businesses - large and small - that cater to the tourists. With the recent recession of 2008 that shows few signs of abating even after two harrowing years, there is a significant need to understand the factors that determine the revenue streams provided by the industry. More specifically, there is a need to understand what makes the tourists spend more money, so that efforts can be made to facilitate it.

Literature Review

In their attempts to understand and analyze the tourism industry various approaches have been attempted by researchers over the years. Some have tried to study the differences caused by demographics (e.g. age, gender, etc.), psychographics (e.g. desired activities, personal motivations, etc.), and other factors. Table 1 highlights some of these attempts.

Methodology

A survey instrument was designed based upon the variables presented in Tables 2A and 2B. Most of the variables had their responses recorded on a

AUTHORS	FACTORS
Strauss & Howe (1991)	Age
Tulgan (1995)	Age (Gen X, Y, etc.)
Stemerding et al (1996)	Leisure
Wilson (1997)	Age (Gen X, Y, etc.) & Wants
Solomon (1997)	Age (Gen X, Y, etc.) & Stress
Cho (1998)	Age
MacKay & Fesenmaier (1998)	Getaway Market
Neuborne and Kerwin (1999)	Age (Gen X, Y, etc.)
Enz et al (1999)	Restaurant
Schaub (1999)	Age (Gen X, Y, etc.)
Halstead (1999)	Age (Gen X, Y, etc.)
Hudson (2000)	Gender
Shoemaker (2000)	Age
Proll & Retschitzegger (2000)	Age (Gen X, Y, etc.)
Chi-yung (2001)	Hotels
May et al (2001)	Snowboarding in Wyoming
Moscardo et al (2001)	Activities-based and geographic
Dolnicar (2002)	Various segmentation schemes
Bieger and Laesser (2002)	Motivational & Foreign travel
Markley (2002)	Age (Gen X, Y, etc.) & Success
McKercher et al (2002)	Activities-based
Parry (2003)	Age (Gen X, Y, etc.)
Fernandez-Cruz (2003)	Age (Gen X, Y, etc.) & Shopping
Weisman (2004)	Age (Gen X, Y, etc.)
Bensley (2004)	Age (Gen X, Y, etc.)
Andreu et al (2005)	Motivational & Foreign travel
Allen (2007)	Age & Life experiences

Table 1: Literature Review Summary

five point Likert scale (1 = strongly disagree and 5 = strongly agree). In

addition, there were a number of demographic questions (e.g. age, income, gender, etc.) that were included in the survey. The survey instrument was pre-tested and modified according to the suggestions made by the participants. The questionnaire was conducted by a designated persons at several malls located in southeast. The participants were approached according to a random number based technique. Table 2A and 2B list the various variables used in the study. 1,271 questionnaires were returned.

VARIABLE	Explanation
cost	importance of cost (not imp=1, very imp=5)
accom	importance of accommodation (not imp=1, very imp=5)
promo	importance of promotional activity (not imp=1, very imp=5)
service	importance of service level (not imp=1, very imp=5)
location	importance of location (not imp=1, very imp=5)
name	importance of brand name (not imp=1, very imp=5)
amenity	importance of amenities offered (not imp=1, very imp=5)
safety	importance of safety (not imp=1, very imp=5)
attract	importance of number of attractions (not imp=1, very imp=5)
warm	prefer warm places (SD=1, SA=5)
cooler	prefer cooler places (SD=1, SA=5)
beach	prefer places with beach access (SD=1, SA=5)
mnts	prefer places with mountains (SD=1, SA=5)
desert	prefer places with deserts (SD=1, SA=5)
restaura	prefer places with lots of restaurants (SD=1, SA=5)
meseums	prefer places with lots of museums (SD=1, SA=5)
nightlif	prefer places with nightlife (SD=1, SA=5)
shop	prefer places to shop (SD=1, SA=5)
foreign	prefer foreign destinations (SD=1, SA=5)
newplce	prefer new destinations (SD=1, SA=5)
same	prefer returning to familiar destinations (SD=1, SA=5)
sept11	events of 9/11 have influenced my destination (SD=1, SA=5)
gasprce	gas prices have influenced my destination (SD=1, SA=5)
terroris	terrorism has influenced my destination (SD=1, SA=5)
advance	tend to plan in advance (SD=1, SA=5)
simppl	prefer places having similar people (SD=1, SA=5)
pplage	prefer places having people of my age (SD=1, SA=5)
skiing	prefer places that offer skiing (SD=1, SA=5)
golf	prefer places that offer golf (SD=1, SA=5)
partying	prefer places that offer partying (SD=1, SA=5)
wsports	prefer places that offer water sports (SD=1, SA=5)
timeofyr1	time of year is summer (yes=1, no=0)

timeofyr2	time of year is fall (yes=1, no=0)
timeofyr3	time of year is winter (yes=1, no=0)
timeofyr4	time of year is spring (yes=1, no=0)
mode1	travel by car (yes=1, no=0)
mode2	travel by bus (yes=1, no=0)
mode3	travel by rail (yes=1, no=0)
mode4	travel by water (yes=1, no=0)
mode5	travel by air (yes=1, no=0)
mode6	travel by other means (yes=1, no=0)
stayat1	stay at a luxury motel (yes=1, no=0)
stayat2	stay at a campground site (yes=1, no=0)
stayat3	stay at a budget hotel (yes=1, no=0)
stayat4	stay with friends or family (yes=1, no=0)
stayat5	stay at a rental (yes=1, no=0)
stayat6	stay at a bed and breakfast (yes=1, no=0)
stayat7	stay at a hostel (yes=1, no=0)
VARIABLE	Explanation
family	prefer places having family activities (SD=1, SA=5)
romance	prefer places providing romantic getaways (SD=1, SA=5)
gambling	prefer places providing gambling (SD=1, SA=5)
shopping	prefer places that offer lots of shopping (SD=1, SA=5)
sightsee	prefer places providing sightseeing (SD=1, SA=5)
cultural	prefer places having a rich culture (SD=1, SA=5)
concert	prefer places that host concerts (SD=1, SA=5)
sporting	prefer places that host sporting events (SD=1, SA=5)
randr	prefer places to relax and recuperate (SD=1, SA=5)
locale1	destination is urban (yes=1, no=0)
locale2	destination is secluded (yes=1, no=0)
locale3	destination is a resort (yes=1, no=0)
gender1	female (yes=1, no=0)
gender2	male (yes=1, no=0)
marital1	married (yes=1, no=0)
marital2	not married (yes=1, no=0)
children	number of children at home (midpoint of range taken)
age	age of visitor (midpoint of range taken)
ethnic1	caucasian (yes=1, no=0)
ethnic2	african american (yes=1, no=0)
ethnic3	asian american (yes=1, no=0)
ethnic4	hispanic (yes=1, no=0)
ethnic5	other (yes=1, no=0)
income	annual income of visitor (midpoint of range taken)
education	years of education incl HS (midpoint of range taken)
party	prefer places that let me party (SD=1, SA=5)
tripattr	prefer places that make memories (SD=1, SA=5)
worries	prefer places that take my worries away (SD=1, SA=5)
coolplaces	prefer to visit "cool" places (SD=1, SA=5)
boring	prefer places others may find boring (SD=1, SA=5)
likeme	prefer places where people would like me (SD=1, SA=5)
info1	obtained info from the Internet (yes=1, no=0)
info2	obtained info from a travel agency (yes=1, no=0)

Table 2A: Variables Used in the Study

info3	obtained info from friends and family (yes=1, no=0)
info4	obtained info from magazines (yes=1, no=0)
info5	obtained info from other sources (yes=1, no=0)
where1	travel within North Carolina (yes=1, no=0)
where2	travel within the southeast (yes=1, no=0)
where3	travel within the United States (yes=1, no=0)
where4	travel outside the United States (yes=1, no=0)
travelw1	traveling alone (yes=1, no=0)
travelw2	traveling with one other person (yes=1, no=0)
travelw3	traveling with a group of friends (yes=1, no=0)
travelw4	traveling with an organized tour (yes=1, no=0)
travelw5	traveling with the family (yes=1, no=0)
numyr	trips per year (midpoint of range taken)
overnigh	number of days of overnight stays during trips
spend	amount spent per night (midpoint of range taken)
tcost	total cost of trip

Table 2B: Variables Used in the Study

Analysis

The analysis was conducted in two steps. In the first step, cluster analysis was attempted on the entire data set to see if the data could be partitioned into well-behaved subsets based on some demographic variables (e.g. age, gender, income, etc.). Using SPSS version 18, several demographic variables were fed into the cluster analysis model as initial clusters. As it turned out, most of the demographic variables were constant across clusters in the final analysis and had to be removed. Only two variables, SPEND and INCOME ended up in the final result. The end result was only 3 clusters having the following attributes.

Variable	Cluster 1	Cluster 2	Cluster 3
SPEND	145	56	85
INCOME	63.3	30.6	96.1
N	432	494	345

Each of the three clusters was separated and analyzed using a backward propagation neural network. Neural networks are a well-established statistical technique in the literature. Its modeling and predictive ability has often been touted as superior to conventional statistical approaches. To facilitate the modeling process, Predict software produced by NeuralWare, Inc. was chosen. The software has a wizard to facilitate the data classification process. Once the input and output variables have been identified, the wizard allocates one neuron per input and attempts to create a neural network using a training and testing phase. A portion of the data is kept aside for testing. During the training phase, both the input variables and the desired values of output variables are presented to the neural network. A trained network is tested by asking the neural network to predict the output value for a given set of input variables.

The results of cluster 1, 2, and 3 are shown in figures 1, 2, and 3 respectively. The modeling results are presented in two parts. The first part depicts the results of the training and testing process employed. Several terms are introduced in the first part. A brief description of the same is as follows:

R: Linear correlation between the actual output and the model output
Net-R: Linear correlation between actual and raw neural net output

Avg. Abs.: Average absolute error between actual and model output
RMS: Root mean square error between the actual and model output
Accuracy Measure: Fraction of model output within 20% of actual output
CI: Predicted values are within this distance of target with 95% confidence

The second part of the analysis contains two key outputs “average” and “contribution”. The average term is derived by doing a sensitivity analysis on the basic model. The contribution term determines the how the output is influenced by the variable listed on a 100 point scale.

Sensitivity analysis in a Predict model helps us determine the effect of small changes in an input value on the price. This can be quite insightful. To facilitate analysis, it also ranks the input fields according to this sensitivity. Mathematically, sensitivity analysis is a basically a matrix of partial derivatives of output variable with respect to input variables. Sensitivity analysis has the potential of providing good modeling insights. If the input values can be controlled, sensitivity analysis shows which fields should be changed and in which direction to achieve the desired output. A positive mean value implies that increasing the input value will increase the output by the mean value (on average), and vice versa. It is Important to note that highly sensitive fields may not necessarily be important fields for an application.

To study the sensitivity of an input variable with respect to the output variable, the input variable's value is altered while keeping all other inputs constant and the change in price is noted. This procedure is used on all variables, for all observations, for all models.

To gauge the contribution of each variable towards the output variable, the Predict software performs a contribution analysis. To implement it, the model is run in standard mode for the current record. For each non-missing field in turn, its value is replaced by the mid-range value and a modified output is calculated. The absolute difference between the original neural net output and the modified neural net output is calculated for each non-missing field. This is referred to as the "delta" for the non-missing field. The delta is scaled on a 100 point scale.

Results

The tourists tend to fall in one of three categories. The first category tourists have an average income of \$63,300 and spend \$145 on a night's stay at a hotel. The second category tourists have an average income of \$30,600 and spend \$56 on a night's stay a hotel. Third category tourists have an average income of \$96,100 and spend \$85 on a night's stay. It is interesting to note that the highest income group did not spend the most on their night's stay.

According to the contribution analysis, the first cluster is likely to be primarily African Americans staying with friends and family and traveling outside the country. The group size and travel destination (e.g. a cruise) could be one of the reasons for the high cost of overnight stay.

The second cluster has no ethnicity preference. They are very budget conscious and tend to stay at campground sites as opposed to a hotel, generally pick a location in the US, and like to party. This makes sense since this group has the lowest income of the three clusters (\$30,600).

The third cluster likes overnight stays, enjoys the desert, like to stay at camp sites, and enjoy partying. While watching their spending, this group spends a lot more than the second cluster. Since their income is the highest, they are more likely to use charge cards with high limits to pay for expenses.

Conclusion

Analyzing aggregate tourist data is hard. Individual behaviors can easily be camouflaged by averaging. This is evidenced by the fact that none of tourists' activities made it into the high contribution category. With the current data it's hard to tell if more tourists will go near the beach, eat sea food, or hit the

ski slopes. Additional data and data analysis using sophisticated statistical techniques are needed to better understand the tourism industry.

TCOST	R	Avg Abs	Max Abs	RMS	Accuracy	CI
Train	0.8202	163	689.4	204.5	79.50%	399.4
Test	0.7419	183.7	700.5	235.5	71.50%	463

NAME	Average	Variance	NAME	Average	Variance
numyr	0.61	0.50	gasprce	-0.02	0.03
overnigh	0.24	0.03	where1	-0.05	0.01
spend	0.18	0.02	age	-0.05	0.04
where4	0.15	0.00	gambling	-0.06	0.05
income	0.11	0.03	coolplaces	-0.11	0.18
travelw5	0.08	0.01	stayat4	-0.13	0.01
location	0.05	0.03	ethnic2	-0.20	0.01
gender1	0.00	0.00	education	-0.25	0.38

Variable	Contrib	Variable	Contrib
ethnic2	62	overnigh	22
where4	49	education	22
spend	45	age	15
stayat4	41	gambling	15
numyr	34	income	15
coolplaces	24	gasprce	11
travelw5	24	location	9
where1	23	gender1	6

Figure 1: Results of Cluster 1

TCOST	R	Avg Abs	Max Abs	RMS	Accuracy	CI
Train	0.4968	161.1	1039.9	217	79.50%	424
Test	0.5352	157.6	867.5	208.4	71.50%	409

TCOST	Average	Variance	TCOST	Average	Variance
children	2.08	2.37	service	0.03	0.00
overnigh	0.19	0.01	stayat5	0.02	0.00
spend	0.15	0.00	mtns	0.02	0.00
income	0.14	0.01	age	-0.01	0.00
party	0.10	0.00	coolplaces	-0.02	0.00
where3	0.08	0.00	shop	-0.05	0.00
name	0.06	0.00	same	-0.05	0.00
stayat2	0.03	0.00			

Variable	Contrib	Variable	Contrib
spend	71	children	15
where3	59	name	14
overnigh	55	shop	14
income	38	service	11
stayat2	35	mtns	6
party	23	coolplaces	6
stayat5	22	age	2
same	16		

Figure 2: Results of Cluster 2

TCOST	R	Avg Abs	Max Abs	RMS	Accuracy	CI
Train	0.6389	226.8	750.8	284.8	61.40%	557
Test	0.4582	266.5	825.5	334.5	53.80%	659.4

TCOST	Average	Variance	TCOST	Average	Variance
spend	0.34	0.00	wsports	-0.04	0.00
overnigh	0.26	0.00	museums	-0.04	0.00
desert	0.24	0.02	stayat1	-0.04	0.00
mode1	0.17	0.00	shop	-0.06	0.00
coolplaces	0.14	0.00	ethnic1	-0.09	0.00
pplage	0.11	0.00	education	-0.10	0.00
advance	0.09	0.00	gambling	-0.10	0.01
promo	0.07	0.00	sightsee	-0.17	0.02
stayat2	0.05	0.00	party	-0.22	0.02
partying	0.02	0.00			

Variable	Contrib	Variable	Contrib
spend	53	sightsee	20
overnigh	52	pplage	20
desert	39	advance	17
stayat2	38	shop	12
party	31	promo	11
education	27	wsports	6
stayat1	24	museums	6
coolplaces	23	partying	5
gambling	20	foreign	3

Figure 3: Results of Cluster 3

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CYBERSPACE POLICY REVIEW AND THE NATIONAL STRATEGY FOR TRUSTED IDENTITY IN CYBERSPACE

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ABSTRACT

This paper gives a brief but substantial review of two documents promulgated by the U.S. Office of the President: the *Cyberspace Policy Review* and the *National Strategy for Trusted Identity in Cyberspace*. An identity ecosystem, consisting of participants and infrastructure, is proposed and an operational framework is envisioned. The underlying concepts are substantial, and the overall implications should be of interest to the academic, business, and government communities.

KEYWORDS: Cyberspace, Internet, trusted identity, policy, strategy.

INTRODUCTION

Cyberspace policy and a national strategy for trusted identity are in the news, because the current digital infrastructure is inadequate to satisfy the operational needs of a modern society based on computers and the Internet. (White House 2010a and 2010b) An identity ecosystem is proposed to mitigate identity theft, fraud, and digital crime through an overall awareness of the root causes of information and communications security problems. (OECD 2008) The existing Internet is based on an open society, and a myriad of operational and security problems have evolved. It is generally felt that “leadership from the top” is needed to remedy the existing situation. Accordingly, the United States Office of the President has orchestrated a public/private 60-day clean-slate review of the existing U.S. policies and structures for cybersecurity. (White House 2010a) This paper gives a review of that initiative from a service science perspective. We will be taking a look at two documents, available from the White House at www.whitehouse.gov: *Cyberspace Policy Review* and the *National Strategy for Trusted Identity in Cyberspace*.

BACKGROUND

Several definitions are relevant to the ensuing review: identity, mission, strategy, governance, policy, service, and service system. *Identity* is means of denoting a subject in a particular namespace and is the cornerstone of security and privacy. A subject may have several identities and be associated with more than one namespace. A subject’s identity may be self-determined or determined by others. The most trustworthy identities are determined by trusted authorities and established through an identity credential, such as a birth certificate, driver’s license, passport, or military ID card. When one identity management system accepts the identity certification of another, a phenomenon known as “trust” is established, often facilitated by a third party.

Four organizational concepts are important, because they reflect the substance of presentation: mission, strategy, governance, and policy. (Katzan 2008) A *strategy* is “a long-term plan of action designed to achieve a particular goal,” and *governance* is “the set of processes, customs, policies, laws, and institutions affecting the way an endeavor is directed, administered, or controlled. (Wiki 2008) The basic tenet of strategy is that a principal entity desires to accomplish an objective called a *mission*, required in order that an entity knows its direction, and the strategy determines how to get there. Thus, the mission is the subject’s goal, and the strategy is the roadmap for achieving that goal. A strategy is a plan of action. A *policy* – the most problematic of the definitions – is commonly regarded as a set of guiding principles or procedures considered to be advantageous for influencing decisions or establishing courses of action.

Since we will be taking a service perspective, a brief mention of that approach is entertained. A *service* is generally regarded as work performed by one person or group that benefits another. Another definition is that it is a type of business that provides assistance and expertise rather than a tangible product. Still another definition is that it is after-purchase support offered by a product manufacturer or retailer. We are going to refer to it as a provider/client interaction in which both parties participate and both parties obtain some benefit from the relationship. The provider and the client exchange information and adopt differing roles in the process. A *service system* is a collection of resources, economic entities, and other services capable of engaging in and supporting one or more service events. Services, i.e., service processes, may interact or they may be included in a service value chain. This is a recursive definition of a service system that would support the following modalities of service operation: *tell me, show me, help me, and do it for me*. Service systems are inherently multidisciplinary, since a service provider may not have the knowledge, skill, time, resources, and inclination to perform all of the steps in a service process and require the services of an external service provider. (Katzan 2009) The service perspective is particularly appropriate to the study of interacting components in a trusted identity system.

CYBERSPACE POLICY PRELIMINARIES

Within this paper, *cyberspace* is defined as the interdependent network of information technology components that underpin most of our digital communications. (White House 2010b, p. 1) Many persons are affected by cyberspace, since it is a platform for business, education, government, and daily affairs. There is an overwhelming concern for the security of cyberspace, since its use has exceeded the original architecture. Cyberspace is additionally a convenient means for government, business, and education to exercise their responsibility to their constituents and serves as backbone for social networking. Many persons feel that software errors and negligent human behavior are responsible for Internet security problems, and are as much a security problem as the technical infrastructure. (OECD 2008)

Regardless of the root causes of concerns over security in cyberspace, it would appear that the following tenets apply, since a secure cyberspace is necessary for continued support for the U.S. economy, civil infrastructure, public safety, and national security: (White House 2010a)

- The Nation is at a crossroads
- The status quo is no longer acceptable
- A national dialogue on cybersecurity is needed
- The U.S. cannot succeed with cybersecurity in isolation
- The U.S. cannot outsource its responsibility
- A public and private dialogue is required for the establishing of a secure cyber infrastructure

It follows that cybersecurity should address mission-critical principles for computer network defense, law enforcement investigations, military and intelligence activities, and the intersection of information assurance, counterintelligence, counterterrorism, telecommunications policies, and general critical infrastructure protection. (White House 2010a, p.2)

CYBERSECURITY POLICY PRINCIPLES

In order to make cybersecurity a national priority affecting the U.S. goals of economic growth, civil liberties, privacy protection, national security, and social advancement, a set of guiding principles would necessarily apply. Here is the set of principles as espoused by the subject document:

Principle #1: Leading from the Top

The intension of this principle is that leadership should emanate from the White House, since no other entity has responsibility to coordinate Federal government cybersecurity-related activities. A cybersecurity policy official is proposed with operational authority to assure effective implementation of the strategy.

Principle #2: Building Capacity for a Digital Nation

The Internet and computers have transformed most aspects of daily life, and in order for security to persist, risk awareness should be addressed through a “public awareness” program, an enhanced education system, and a capable workforce to address the relevant subjects.

Principle #3: Sharing Responsibility for Cybersecurity

This principle insures that developments in cybersecurity will result from a partnership between the private sector and the government, as well as with the international community.

Principle #4: Creating Effective Information Sharing and Incident Response

A comprehensive framework for coordinated response from relevant parties to cybersecurity events is necessary for continued success and enhancement of a cyber ecosystem. Information sharing is required for this endeavor with the overall accountability being anchored in the office of the cybersecurity policy official.

Principle #5: Encouraging Innovation

Technical innovation in telecommunications infrastructure products and service is anticipated and encouraged. A single vision is needed to guide decision-making by the private sector, academia, and government. An R&D framework to link research to development, that is lead by the cybersecurity official, is proposed.

The Cyberspace Policy Review document concludes with near-term and mid-term action plans for the implementation of cybersecurity.

Analysis. The document entitled “Cyberspace Policy Review” is an exceedingly well-written and comprehensive review of Internet security provisions sponsored by the Federal Government with public/private cooperation. However, the content of the policy review reads more as a mission statement than a set of policy principles. The report succeeds, because it resists the temptation to venture into strategy and cybersecurity technology. The policy review presents a service system where the Federal Government is the service provider, and the stakeholders are the service clients. In fact, the proposed identity management system demonstrates two concepts in service science: collectivism and duality. (Katzan 2010) Collectively, the ontological elements of the identity management system provide a service to a subscriber, and the subscriber demonstrates service duality to the identity system, as a client without which the identity system could not exist.

NATIONAL STRATEGY FOR TRUSTED IDENTITY PRELIMINARIES

A key aspect of mitigating online crime and identity theft is to increase the level of trust between parties in cyberspace transactions. In this context, usage of the term “trust” is intended to imply that the subject and relying party are actually who they say they are. The strategy seeks to delineate methods to raise the level of trust associated with the digital identities of individuals, organizations, services, and digital components through a trusted cyber ecosystem so as to enhance the following: (White House 2010b)

- Security

- Efficiency
- Ease of use
- Confidence
- Increased privacy
- Greater choice
- Innovation

The overall objectives of the endeavor are to increase the protection of personal privacy through the following goals: (White House *op cit.*, p. 2)

Goal 1: Develop a comprehensive Identity Ecosystem Framework

Goal 2: Build and implement an interoperable identity infrastructure aligned with the Identity Ecosystem Framework

Goal 3: Enhance confidence and willingness to participate in the Identity Ecosystem

Goal 4: Ensure the long-term success of the Identity Ecosystem

Nine comprehensive actions are anticipated to align the strategy with operational reality: (White House *op cit.*, p. 2-3)

Action 1: Designate a Federal Agency to lead the public/private sector efforts associated with achieving the goals of the strategy

Action 2: Develop a shared, comprehensive public/private sector implementation plan

Action 3: Accelerate the expansion of Federal services, pilots, and policies that align with the identity ecosystem

Action 4: Work among the public/private sectors to implement enhanced privacy protections

Action 5: Coordinate the development and refinement of risk models and interoperability standards

Action 6: Address the liability concerns of service providers and individuals

Action 7: Perform outreach and awareness across all stakeholders

Action 8: Continue collaborating in international efforts

Action 9: Identify other means to drive adoption of the identity ecosystem across the Nation

It is anticipated that the Executive Office of the President (EOP) will be the lead agency in the above actions.

The *identity ecosystem*, comprised of transaction participants and an operational trust infrastructure, is the paradigm for the national strategy. The guiding principle for trusted identity is that there will be standardized and reliable identical credentials, methods of insuring those credentials, and relying parties that accept the trusted identities. It is up to the designers of the identity ecosystem to determine how the presented ideas will interoperate.

IDENTITY ECOSYSTEM FRAMEWORK (IEF)

The IEF is conceptualized as being comprised of three layers:

- The *execution layer* that conducts transactions according to rules of the identity ecosystem
- The *management layer* that applies and enforces the rules
- The *governance layer* establishes the rules and operations

A basic set of ontological elements relevant to the IEF are summarized in Table 1.

Table 1. Basic Set of Ontological Elements Comprising the Identity Ecosystem Framework.

<i>Element</i>	<i>Definition</i>
Accreditation Authority	Assesses and validates that identity providers, attribute providers, relying parties, and identity media adhere to an agreed upon Trust Framework.
Attribute Provider	Responsible for all the processes associated with establishing and maintaining a subject's identity attributes; they provide assertions of the attributes to the individuals, other providers, and relying parties.
Credential	An information object created by a credential provider that provides evidence of the subject's authority, roles, rights, privileges, and other attributes. The credential is normally bound to an acceptable identity medium.
Digital Identity	The electronic representation of an entity (e.g., a device, software, service, organization, or individual) in cyberspace that is comprised of an information artifact or correlated information sets.
Governance Authority	Oversees and maintains the Identity Ecosystem Framework and defines the rules by which a product or service provider in the Identity Ecosystem attains trustmarks.
Identity Ecosystem	It is an online environment where individuals, organizations, services, and devices can trust each other because authoritative sources establish and authenticate their digital identities.
Identity (1)	A unique physical being that identifies somebody or something. Identities can apply to persons or non-persons (NPE).
Identity (2)	A unique name of an individual person. Since the legal names of persons are not necessarily unique, the identity of a person must include sufficient additional information (for example, an address, or some unique identifier such as an employee or account number) to make the name unique.
Identity Provider (IDP)	Responsible for processes associated with enrolling a subject and establishing and maintaining the digital identity associated with an individual or NPE. These

	processes include identity vetting and proofing, as well as revocation, suspension, and recovery of the digital identity. The IDP is responsible for issuing a credential, the information object or device used during a transaction to provide evidence of the subject's identity; it may also provide linkage to authority, roles, rights, privileges, and other attributes.
Identity Proofing	The process of providing sufficient information (e.g., identity history, credentials, documents) to a service provider for the purpose of proving that a person or object is the same person or object it claims to be.
Relying Party (1)	A relying party is a provider of online services to a subject. Within the ecosystem, a relying party is responsible for interacting with credential, identity, and attribute providers as needed to verify parties with whom they exchange information.
Relying Party (2)	An entity that relies upon the Subscriber's credentials or Verifier's assertion of an identity, typically to process a transaction or grant access to information or a system.
Trustmark	A badge, seal, image, or logo that indicates a product, device, or service provider has met the requirements of the identity ecosystem, as determined by an accreditation authority. To maintain trustmark integrity, the trustmark itself must be resistant to tampering and forgery; participants should be able to both visually and electronically validate its authenticity. The trustmark provides a visual symbol to serve as an aid for individuals and organization to make informed choices about the providers and identity media they use.

(Source: White House 2010b, Katzan 2010d)

The *executive layer* is the place where participants and service components come together to instantiate a trusted transaction. The subject will possess an *identity credential* and the relying party will possess a *trustmark*. Both participants can request verification from a *certified provider*, which can supply identity attribute data, as required. Subjects and relying parties register with the identity provider beforehand. A sponsor may be required for proper registration.

Clearly, the subject and relying party are outside of the basic cyber infrastructure, whereas the identity provider and supporting elements are subsumed in the identity ecosystem framework. The ecosystem provides a service to the relying party, and the relying party provides a service to the subject.

The *management layer* is the component that handles credentials, attributes, and registration. A subject and a relying party must register with at least one identity provider. Identity validation is performed by the identity provider according to rules established at the governance layer for use in the management layer. The notion of an attribute provider is conceptualized but appears to be an operational item requiring further study.

The *governance layer* will provide facilities for assessing and certifying identity ecosystem service providers through a Governance Authority, conceptualized to control the rules for identity and trusted certification to identity providers and service providers (i.e., relying parties). Before any participant, with the exception of individuals, can join the identity ecosystem framework, it must be certified by an accreditation authority to insure that the service provider is trustworthy.

As a conceptual entity, the identity ecosystem will have the following characteristics: (White House op cit., p. 17)

- Individuals and organizations choose the providers they use and the way they conduct transactions securely.
- Participants can trust one another and have confidence that their transactions are secure.
- Individuals can conduct transactions online with multiple organizations without sacrificing privacy.
- Identity solutions are simple for individuals to use and efficient for providers.
- Identity solutions are scalable and evolve over time.

and provide the following benefits for individuals:

- Security
- Efficiency
- Ease-of-use
- Confidence
- Privacy
- Choice

Analysis. The proposed National Strategy for Trusted Identity in Cyberspace appears to be a well-conceived vision for future operations in a global society based on the Internet. Many persons feel that the Internet security problems are simply the result of buggy code and careless users. However, the identity problem still remains. Without a trusted authority, how do you know that the participant on the other end of the line is who he says he is?

SUMMARY

The reports addressed by this paper are long and complex document, consisting of 65 and 36 pages, respectively. A comprehensive summary would be long and tedious. One approach could be that the contents be summarized by the 8 Fair Information Practice Principles (FIPPs): (White House op cit., p. 36):

- Transparency

- Individual Participation
- Purpose Specification
- Data Minimization
- Use Limitation
- Data Quality and Integrity
- Security
- Accountability and Auditing

The principles are rooted in the United States Department of Health, Education, and Welfare's report entitled *Records, Computers, and the Rights of Citizens*. "The universal application of FIPPs provides the basis for confidence and trust in online transactions."

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GIVING THE CUSTOMER A VOICE IN THE BUSINESS OF GOVERNMENT

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ABSTRACT

The United States government manages the largest businesses on the planet from the business of defense to the business of education. Just imagine the gains in efficiency and effectiveness if every government applied the power of customer loyalty by listening to and responding to the voice of the customer. This paper describes the planning involved, outcomes and lessons-learned when the CFO Directorate of one public sector organization moved into this uncharted territory.

INTRODUCTION

Two little girls set up a lemonade stand across the street from one of the authors' houses. The author walked over to support these young entrepreneurs and heard Emma (age 7) say to Emily (age 7), "here comes a customer." Two weeks earlier this author attended the first ever IT Conference of a prominent federal government agency and only heard the word "customer" once during that three day event.

What causes leaders and managers to lose the customer focus that's so natural when they were seven years old? This article will not answer that complex question but will describe one Chief Financial Officer's journey into the uncharted territory of building customer relationships in a very large federal agency by using the voice of the customer (VOC), a part of quality function deployment (QFD) methodology. The names and their affiliation will remain anonymous but the fact situation, challenges, methods and lessons-learned all apply to any organization, public or private sector that has lost its customer focus.

LITERATURE REVIEW

The customer is the one who evaluates and pays for a product or service. This is very clear in the lemonade stand business; it's not at all clear in the public sector. For example, in the public sector, the taxpayer pays but most often someone else evaluates the product or service. It's easy to confuse customers and stakeholders. A stakeholder, as the name implies, has a stake in the organization's success. The customer is one of many stakeholders; others include suppliers, employees, the local community, Congress, the taxpayer and so on [3, 5]. Both Hall and Hyde [5, 6] have noted that identifying the customer in the public sector is problematic, and therefore complicates the process of meeting customer needs.

Nevertheless, a variety of quality tools have been applied to the public sector in an effort to improve quality. For example, Connecticut's Department of Labor (DOL) utilized the VOC to reengineer its department when it was determined that, as is common, employees were recognized for managing information and resources but not serving the customer [7]. Once the DOL felt it was ready for successful change, it started at the end of the reengineering chain of activities by listening to what the customer wanted and expected, and worked backward by designing the processes accordingly. Many have pointed out that the VOC is a part of quality function deployment (QFD) which translates the needs of the customer, or "whats," into "how" the organization is going to meet those needs [3, 4, 11].

Although QFD has historically been applied to the private manufacturing sector, there is evidence that it can be just as effective when applied to the public service sector. Hall [5] presents the idea of using QFD to align the public organization in an effort to meet the requirements of its external customers. Selen and Schepers [11] report on the application of QFD to police services in Belgium to better coordinate the requirements of the general public and authorities with the services deployed by the police station.

In addition to using QFD to listen to the voice of the external customer, many authors have presented the idea that QFD can be used with internal customers as well [2, 3, 4]. By utilizing QFD internally, an organization can document the expectations of customers and the processes currently in use to meet these expectations. Although QFD is not being used as originally intended, this application can be useful to identify a variety of measures and then focus on the key measures relevant to the organization's customers [4]. The information gap between external and internal customers can also be reduced with the use of QFD by correlating user requirements to a realistic view of the service delivery that can be provided. This enables organizations to disseminate clear, quantifiable service objectives and standards to its employees. QFD utilized in this way also enhances employee motivation and understanding by unity of purpose, strategic direction, and personal contribution [2]. Ultimately the internal customer is working to meet or exceed the expectations of the external customer either directly or by providing services to another internal customer directly serving the external customer [3].

A variety of organizations have applied QFD in a manner that consciously incorporates the needs of both the internal and external customer. Health care services are a prime example. Chang & Chen [1] report on the use of QFD to develop a continuing care system of discharge planning which meets the needs of the patient's family as well as those of the long-term care facility. Einspruch [3] describes the process of applying QFD to rehabilitation services. A survey instrument was administered among the various internal and external customer groups in an effort to develop a blueprint for the use of QFD within the health care industry. A variation of QFD was used to provide a mathematical foundation for budgetary planning for business and defence organizations in Uruguay [9]; and Curry and Herbert [2] present the application of QFD to strategic planning in a Scottish community education service. The hope is to improve performance by closing the gap related to information, service design and delivery.

VOC/QFD was designed to identify the external customer's wants in private sector manufacturing and then to determine how to meet those wants. The applications presented above indicate that VOC/QFD also works effectively with the internal and external customer's

wants in the public service sector. This paper focuses exclusively on utilizing VOC/QFD techniques with internal customers within a U.S. government agency. The development of the application and its outcomes and lessons learned are presented below. Applying this type of quality technique to internal customers, or any customers for that matter, represents a very new approach for the U.S. government.

METHODOLOGY

Business context

The following diagram uses the SIPOC (Suppliers-Inputs-Processes-Outputs-Customers) Model (Figure 1) to describe any business [10]. It completely describes Navy's business at Pearl Harbor and yet describes Joe's T-shirt business operating on the beach nearby. With that concept in mind, an organization applies its resources to three pressure points common to every business (depicted on the following diagram at A, B and C).

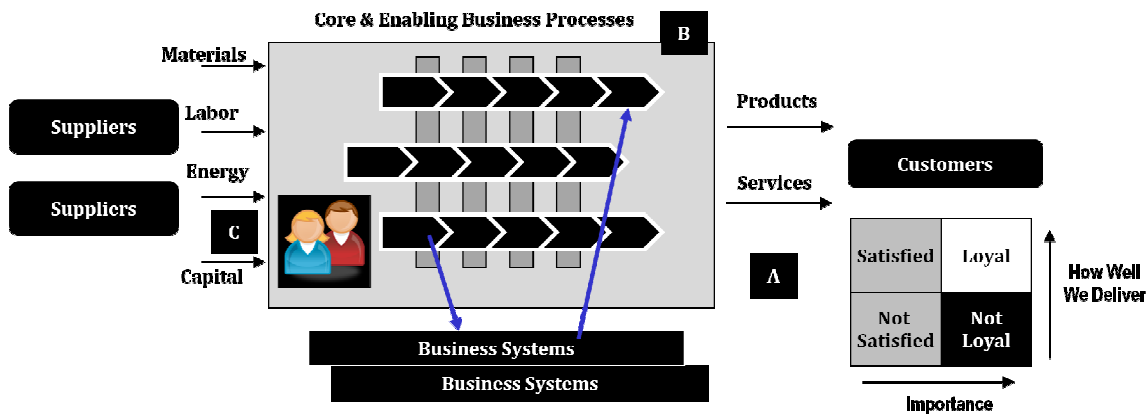


Figure 1

Every business consumes the same four inputs (materials, labor, energy and capital) which the core business processes transform into products and services to meet customer requirements. The enabling processes, shown vertically, do not deliver products or services but work to enable the core processes to do so. Recruiting, hiring, training, budgeting, accounting for contracting costs are all examples of enabling processes.

All processes dip in and out of the business systems to retrieve and deposit information as required by the processes. System examples include ERP (Enterprise Resource Planning), human capital planning, business warehouse, training management and so on.

Mindful of these pressure points, business success depends on how well you are aligned in three key areas:

- A. Strategic Alignment – your vision and goals are so aligned with the customers' critical requirements that you create lasting customer loyalty.

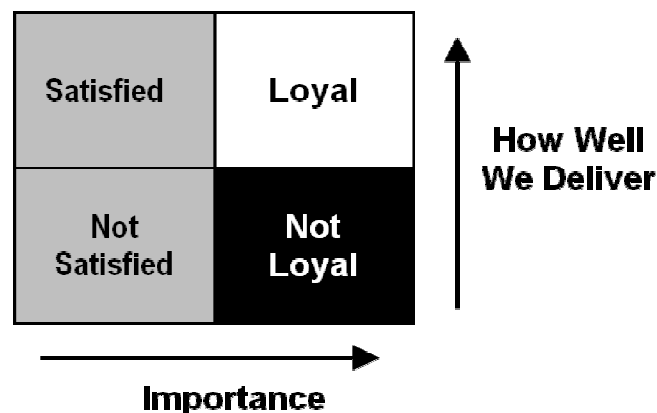
- B. Operational Alignment – your business processes are so well aligned that there’s a clear line of sight to the customer as you look from one end of your process to the other.
- C. Organizational Alignment – all employees, managers and direct reports alike, are going about their work with an eye to continuous process improvement to create loyal customers.

The common thread running through each of these pressure points is “keep your eye on the customer”. This can’t be communicated too often as it’s so easy to lose sight of this most important objective.

Voice of the customer methodology

Every improvement initiative must start with the customer and work backwards from there, and Voice of the Customer (VOC) is how to start. The following Voice of the Customer methodology is designed to completely understand what’s working well and not so well, not in our view but through the customer’s lenses.

- Voice of the Customer engages customers in a conversation to help define, measure and analyze customer perceptions and then to act on that analysis to be sure your organization is performing at its best in areas that matter most to the customer.
- As Figure 2 illustrates, the difference between merely “satisfied” customers and “loyal” customers rests with how well an organization performs in areas that matter most to the customer. Loyalty is just as important in the business of government as we encourage every civil servant to “behave as if” the customer has options.
- Most customer satisfaction surveys ask about features and benefits that we, the supplier, feel are most important. The VOC interview starts by asking the customer what’s most important and then asking how well we’re doing in meeting the requirements quality definition.
- VOC work always involves “noise” which must be filtered out to spotlight the Critical Customer Requirements (CCRs). It’s how you perform against each CCR that predicts customer loyalty behavior.



Customer Loyalty Institute, 1995

Figure 2

Note that private sector businesses recognize that customer loyalty is critical to their long term success. They build loyalty by understanding what's most important to their customers and then focusing attention on doing those things very well.

This same concept applies in the public sector but we rarely think of our customers as having options. We typically view our customers as a captive audience. Although the notion of customer loyalty seems out of place in a public sector setting, we have found that customers do in fact defect when their most important requirements are not met. For example, we have seen directors hire their own external IT professionals when the internal IT organization was not performing to their requirements. Likewise we observed the CFO Directorate becoming a net exporter of talent as the internal customers hired their own financial and budget analysts.

But what if we behave as if the customers have options and that we need to work hard every day to win their trust and earn their business?

QFD methodology

Although, as mentioned earlier, QFD methodology is typically applied to the manufacturing sector, it can easily be applied to the service sector as well. In addition, QFD can be modified to be used with the internal customers of a public sector service agency in an effort to ultimately improve service to its external customers. It is important to note that any organization (private or public sector, manufacturing or service) should get its own house in order before extending QFD efforts to its external customers. Curry and Herbert's [2] basic level of QFD components serves as a template for applying the QFD technique. As Curry and Herbert point out, not all components need be present to successfully utilize the QFD methodology. The basic level components include:

- Identifying customer requirements (wants)
- Ranking these wants in importance
- Specifying the major service parameters (hows)
- Using a scoring system to establish the relationship between wants and hows
- Ranking the hows accordingly, showing the priority of the hows in an effort to achieve maximum customer satisfaction.

As illustrated below, QFD was applied in its most basic form. Customer wants were identified by conducting internal interviews focused on 15 core processes and then ranking the top five processes in terms of importance to the customer; these five processes were discussed in detail with regard to how the services were being delivered and then scored on delivery performance; lastly, the five processes were ranked from best to worst delivery performance in order to focus efforts on those processes identified as most important and needing the most improvement. The activities undertaken to accomplish this application and the resulting implications are presented in detail in the remaining sections of this paper.

Steps the CFO of a large federal agency took

Step #1: Strategic Planning

A Senior Consultant of a technology firm designed and led a series of strategic planning events with the CFO and his direct reports. The objective of this work was to review, confirm and in part create the following strategic planning framework (Figure 3) [8].

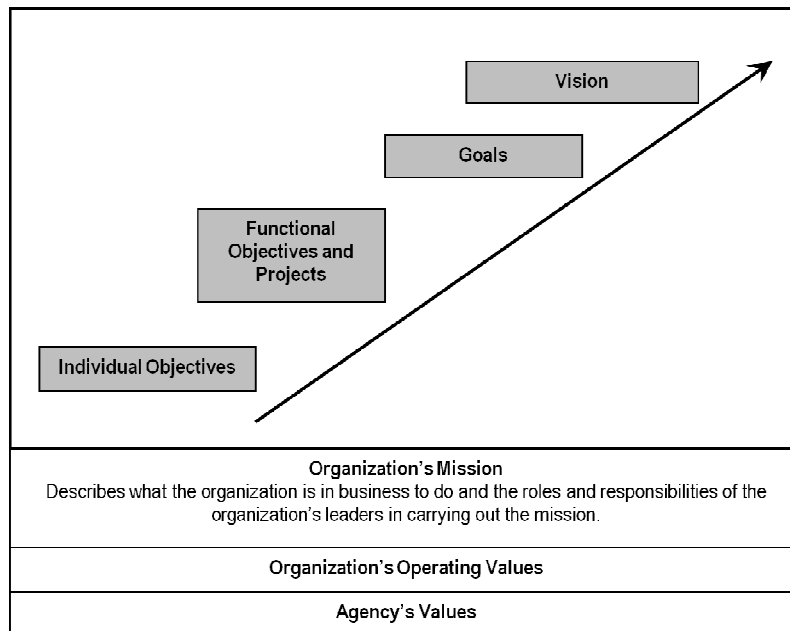


Figure 3

The last in this series of strategic planning events involved the CFO facilitating his leadership team through a teachable point of view exercise that served as the capstone for the strategic planning work.

Participants were issued a challenge: they were not here to pick up a deck of slides. They were to develop their own teachable points of view describing the CFO's strategy. Although each point of view was unique in its style and delivery, each covered the same elements.

- What's the hand we were dealt which included an understanding of how the external environment is changing, and how internal capabilities need to be transformed to take advantage of these external changes?
- What are the winning ideas to address the issues facing the business?
- How will we leverage the CFO's values and behaviors in support of the business ideas?
- What are the edge decisions we face, the tough yes/no decisions around assets, people, processes and systems?

- Last but not least, the CFO encouraged each direct report to practice delivering the point of view in a way that energizes their internal customers and workforce around change and improvement.

The teachable point of view became an integral part of a series of VOC interviews as the CFO discussion leader presented his point of view to tee up the interviews with his immediate customers.

The VOC initiative was designed to engage a specific set of the CFO's internal customers in a conversation about the quality of the CFO's products and services. This set of customers is comprised of the Center Director as well as the 13 directors that report to the Center Director. Each director is responsible for one of the major business activities. Examples include the Operations Director, Director of the Research, the Director of Procurement and the Director of Human Capital.

The VOC design principles include:

- No surveys – instead the CFO conducted a one-on-one interview with each CFO customer at the Director Level, 14 in total.
- The CFO expected to not only collect customer feedback but also to provide information to the CFO's customers.
- The CFO commissioned a VOC team, composed of his direct reports, to design, develop and conduct the interviews. The VOC team agreed that the CFO should not be present at any interview fearing that his presence would affect the tone and outcomes.
- The design team agreed that each VOC interview would follow the same sequence:
 - Open with a brief description of the event using the teachable point of view crafted as part of the strategic planning process.
 - Present and review the CFO's Suite of Services.
 - Follow the interview guide and questionnaire.
 - Solicit the customer's reaction to the VOC approach.
- An interview schedule was developed – which customers, when and who on the CFO leadership team would participate in the interview.

Step #2: CFO's Suite of Services

The CFO recognized that each VOC interview presented an opportunity to discuss the CFO's products and services in support of his internal customer's mission and objectives.

Guided by the SIPOC model, the CFO and his direct reports developed a process-centered Suite of Services listing all of the CFO's core processes. The Budget Planning Process and the Process for Communicating Phasing Plan Status are examples of CFO core processes.

Step #3: Voice of the Customer Interviews

The VOC interviews were conducted with the 13 directors and the Center Director with the following objectives:

Tangible...

- Offer customers a “voice” in the CFO business.
- Measure customer perceived quality - what’s most important to them and how well are we doing delivering what’s most important.
- Collect actionable feedback to guide corrective action.
- Demonstrate interest in and concern for the customer.
- Mark the start of a repeatable customer engagement process.

Intangible...

- Encourages participants to think of themselves as “customers”.
- We value customer “loyalty”; we’re running the business as if our customers have options.
- We value customer feedback that’s not limited to surveys.
- The opportunity to record and report feedback to the CFO is therapeutic.

Each VOC interview is also designed to build a partnership aimed at helping the immediate customers find the most effective ways to meet their customers’ requirements. In this way, the VOC conversation extends to and through the customers. The customer’s success determines the CFO’s success, in this case.

ANALYSIS OF RESULTS

The CFO’s customers were in agreement on what’s most important to them. The following presents their top five most important core processes selected from among the 15 core processes comprising the CFO’s Suite of Services (Figure 4). The customers’ rating of the CFO’s performance on each process is also included. A 5 point scale was used to rate each core process; with 1 representing Poorly, 2 representing Okay, 3 not used as an option, 4 representing Well, and 5 representing Very Well. Some customers did not rate some factors, explaining the variation in the number of respondents.

Although the CFO’s facilitation of the Budget Planning Process was ranked as the most important core process provided, the internal customers rated the CFO’s performance on this process as 2nd highest among the five processes. The 3rd most important process, keeping funds flowing to the directorates, was rated as being performed best by the CFO; with the 2nd most important process, keeping customers informed on the status of the current year’s phasing plans, being rated lowest in terms of performance. A summary table of importance and performance rating, with 1 being the most important as well as the highest rated, follows (Figure 5). As seen in the table, there is work to be done both in terms of raising the overall performance ratings as well as the CFO placing emphasis on performance improvements for the 2nd highest ranked process, as identified by the internal customers. By utilizing the VOC approach, the CFO now has guidance in terms of where to place time and effort to improve the services provided by his office.

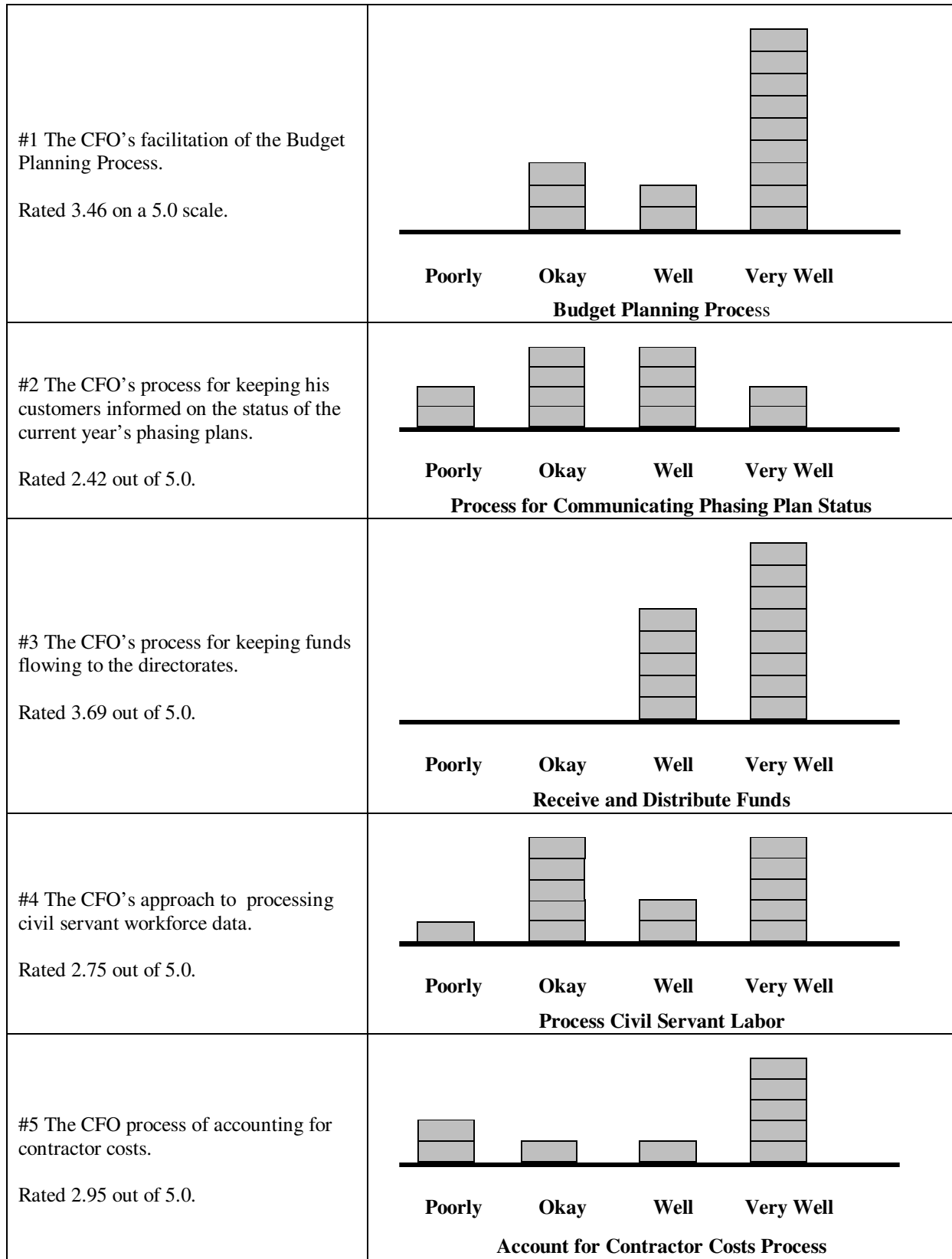


Figure 4

Core Process	Importance	Performance Rating
Budget Planning Process	1	2
Process for Communicating Phasing Plan Status	2	5
Receive and Distribute Funds	3	1
Process Civil Servant Labor	4	4
Account for Contractor Costs Process	5	3

Figure 5

MANAGEMENT IMPLICATIONS

The previous charts represent the VOC headlines and like most headlines, it takes a fair amount of digging to understand the whole story. The CFO leadership team isolated several root causes of their less than satisfactory performance and posed each root cause as a problem to solve:

How do we upgrade the level of analysis performed by the CFO staff across all projects and sub-contracts?

How do we design and institute a CFO-wide policy that emphasizes the importance of staffing stability?

To what extent should we involve the directorate customer in the cost and budget analyst selection process?

Should we equip the cost and budget analysts with customer facing skills that contribute to partnership building?

Can we find a way to streamline the financial data repositories and reporting channels?

Lessons-learned

Most VOC initiatives are led by outside consultants in the spirit of objectivity. It's felt the customers will open up to an outsider. And of course it's much easier to subcontract the work than to mobilize a leadership team to do it all themselves. The CFO rejected this tradition and quickly discovered that each VOC interview helped solidify the CFO leader's teachable point of view.

The VOC interview format was well received versus a customer satisfaction survey. The CFO customers seemed to appreciate the opportunity to discuss CFO performance rather than fill in a series of blanks.

The customers' comments were thoughtful and offered in a spirit of collaboration not punishment. The customers wanted to help and welcomed the opportunity to discuss stress points as well as explore corrective action options.

It was important to anticipate that a Director may not be as aware of the CFO role and inner workings as most of his peers. The result was more time spent reviewing the CFO Suite of Services.

It's important to bring closure to the VOC effort through a Customer Conference to present the VOC findings to all customers at once.

The term "customer" is now a more natural part of the leadership team's vocabulary.

VOC opened the door for on-going customer dialogue and even more feedback. All of which heightens customer expectations.

Summary comments

The SIPOC Model presented in Figure 1 can be used on many levels. This article deals with the CFO Directorate working within a large government agency. The CFO's customers are all internal customers operating within that agency. The SIPOC elements and the VOC participants are very clear.

When applied at the federal agency level, the SIPOC elements and the VOC participants are less defined and often confused. For example, who does the Department of Defense (DoD) reach out to with a VOC initiative? The ultimate customer is the soldier on the ground, the stealth bomber pilot or the admiral of an aircraft carrier. Congress is a vocal DoD customer and the taxpayer certainly has a stake in the DoD's performance; they are the paying customer.

Challenges and excuses aside, what if every government agency behaved as if their customers have options? Quality, cost control, process efficiency and labor productivity would become part of the vocabulary. Customers would have a voice in the business of government. Elected and appointed government officials would listen to the customer as an underpinning of their competitive edge.

Giving the customer a voice in the business of government is fraught with challenges but the payoff is transformational.

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Assessing Presidential Transitions: Bill Clinton's Inaugural Year In Office

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Abstract

A presidential transition is crucial to establishing an effective governance style. New presidents are concerned with building a coherent and cohesive team as they move from their electoral victory to implementing their vision. A successful president will display an entrepreneurial mindset as he proceeds throughout his first year, the inaugural year, in order to achieve early victories. This entrepreneurial approach requires cold-blooded politics and eschews inordinate concern for specific individuals, issues, and policies; it is predicated on nimble governance and shrewd implementation. Presidents must preserve their reputation for effectiveness and their room for maneuver. Nimble governance is choosing among alternative priorities, avoiding blunders, and successfully maneuvering in the face of opposition. Shrewd implementation results in a few, carefully selected initiatives that are announced early, lobbied energetically, enacted swiftly, and executed boldly. These criteria are applied to the inaugural year of the Clinton presidency in our ongoing study of past presidential transitions.

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Assessing the success of any president is an endeavor fraught with difficulties. The period of a transition is perhaps even more complex as the scope of actors involved complicates the analysis. Yet, by studying the transition period, we may draw insights into how generally successful presidents established a successful administration, how generally accepted unsuccessful presidents weakened their administration from their earliest decisions, and how those presidents who stumbled early yet were able to learn from their mistakes managed to right their administration in order to achieve their legislative priorities.

While accepting that a transition begins with the electoral victory, no comparable day exists for marking the termination of the transition (Walker & Reopel, 1986). Assessing success in presidential transitions requires establishing the length of the transition. Popular mileposts frequently cited are the period from election to swearing in or through the president's first hundred days. Noting the raft of initiatives during FDR's inaugural 1933 administration, journalists compared that administration's efforts to the hundred days of Napoleon's campaign after escaping Elba—a period where Napoleon rallied his army, regained Paris, restored his monarchy, fought all of Europe until defeated at Waterloo, and abdicated his crown again. With the Rooseveltian comparison, Americans have appropriated the hundred day period as an unofficial benchmark (Neustadt, 2001). Yet, the hundred day mark is too short a period to accurately assess how well prepared a president is for his four year period of governance.

For this study, the period examined is from election through the end of the first year in office. This period was selected as it provides sufficient time to observe the president and his advisors shifting from a campaign mode to a governance mindset; this almost always involves efforts to heal political wounds within the winning political party and to reach out to the Washington elite (Kumar, 2008). Decisions must be made on priorities, policies, and appointees.

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The inaugural address, which defines the incoming administration's aspirations, is delivered and shapes and influences the first year of effort. From appointees, to supporters, to bureaucrats, to other elected party officials, and even to the loyal opposition, this address informs the actions taken during the inaugural year.

Thus, we believe that this first year of governance provides a sufficiently robust period to examine a presidential transition without being too short to draw any useful insights (Walker & Reopel, 1986). Using the full inaugural year provides a basis for comparison and extends somewhat past the traditional "honeymoon" period newly elected presidents enjoy as the public watches the president's early actions and the opposition is still assessing how to counter the new executive's popularity and policies (Neustadt, 2001). Carter's honeymoon, by most estimates, lasted until September or October of his first year; Reagan's lasted until January or February of his second year; and, George H.W. Bush's also appeared to last until early in his second year (Walker, 1993).

JUDGING THE SUCCESS OF TRANSITIONS

The criteria on which the success of a transition is judged are elusive. Some may judge a new administration by the efficiency of the machinery deployed to promote decisions and actions, by the prompt appointment of capable executives to steer the government effectively and fairly, by how well the administration satisfies its many claimants, or by whether the president and his staff are translating his campaign rhetoric into successful legislative proposals and effectively implementing his policies and programs. None of these criteria are complete by themselves.

The reality of American politics and the peculiarities of the presidency guarantee that each of these defensible ideals is insufficient. Every administration wishes for and strives to

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establish efficient machinery and appoint capable executives. The striving for an efficient transition though is more a bureaucratic virtue than a democratic value. While capable executives are available, the necessity to weigh the appointees' political skills, balance multiple competing constituent groups when selecting various political appointees, and still have someone who can lead his or her department in line with the president's vision present challenges. Many times, it is only after many years have elapsed before the capability of a particular appointee can even be evaluated.

A hopeless task for all politicians, much less a president, is satisfying all the interested political claimants in the extended government community. It is hopeless for a president to attempt to reconcile the many interests that extend from federal employees out to the legions of interest groups and lobbyists extending further into diplomatic missions and beyond to the state and local governments.

Holding any administration to its campaign platform is to argue that national leaders are omniscient, that their preliminary proposals on new policy initiatives and programs are invariably correct, and that presidents and their advisors cannot learn from their campaigns. Campaign policy initiatives are similar to war plans. In battle, it is often said that plans do not survive the first shock of combat, and campaign promises are too often altered by the impact of political and budgetary limitations. Thus, defining the national interest is a hopeless injunction. Furthermore, domestic and international events are impossible to predict, new issues emerge, and circumstances change. From this, it is apparent that if we ask of presidents to deliver only what they have promised, then they are doomed to fail (Walker, 1993).

Considering the above discussion, what then is a sensible standard of success for presidential transitions? We argue that the new chief executive should act as an entrepreneurial

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president (Walker, 1993). One of the earliest political philosophers, Niccolo Machiavelli, articulated a vision of entrepreneurial leadership that we draw upon:

. . . A Prince should know how to use the beast's nature wisely; he ought of beasts to choose both the lion and the fox; for the lion cannot guard himself from the toils, nor the fox from wolves. He must therefore be a fox to discern toils, and a lion to drive off wolves.

To rely wholly on the lion is unwise; and for this reason a prudent Prince neither can nor ought to keep his word when to keep it is hurtful to him and the causes which led him to pledge it are removed (1910: 60).

An entrepreneurial president understands and deploys nimble governance (the lion) and shrewd implementation (the fox). Nimble governance means choosing among alternative priorities, avoiding mistakes, successfully maneuvering in the face of overwhelming opposition and persuading supporters and appeasing opponents in Congress. Concomitantly, we define shrewd implementation as announcing new policies and programs early that are lobbied energetically, enacted swiftly, and executed boldly (Brody & Page, 1975).

Nimble Governance

Drawing on the framework discussed in Walker's (1993) examination of the transitions of the Carter, Reagan, and George H.W. Bush transitions, we will begin by examining the issues of nimble governance and shrewd implementation.

In all transitions newly elected presidents make specific choices from their litany of campaign promises. Each campaign promise cannot be proposed and enacted during the transition much less within the four years of a presidential term. The entrepreneurial executive looks to the future of the administration as a marathon to be endured and completed rather than a sprint to be won. A sage president will select several dominant issues and focus on them; perhaps six or seven more may be championed by the new president's cabinet heads or

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shepherded by the president's party through Congress with little more than the president's blessing.

The nation does expect that the new president's focus in office to be similar to his focus during his campaign. Yet, we should also anticipate that the actual details of new policies and programs will be modified by a new president's interaction with the electorate and by his confrontation with domestic and international realities; however, a successful president cannot allow a dissonance to arise between his stated goals for the administration and the earliest confronted issues tackled by his administration.

Blunders must be cautiously sidestepped. Appointing administrators or promoting issues that ignite government and citizen opposition sap a new administration of its political capital. Adroit maneuvering is imperative in the success of any transition. Invariably presidents and their advisors misjudge and underestimate their opponents particularly in the opening weeks of a new administration. New, successful administrations are agile in creating an environment of order and congeniality with both the old and new centers of power within the government. Political missteps will occur to every administration, especially during the transitional period, and the most successful presidencies are adept at graceful exits from ill-considered misjudgments and are proficient at redirecting attention to new issues.

Acquiring supportive coalitions and disarming opponents are other important criteria for measuring successful presidential transitions. The president invariably faces a new Congress that is also in a state of transition. This new Congress has its own priorities that the president must consider. Thus, the president's early actions must be effective in co-opting others' issues and support and then blending all into a coherent legislative agenda. His charisma, grace, and style are essential in reconciling his own party's disaffected members and affiliated interest groups.

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Also requiring attention are the leaders of the opposition party, especially those in Congress, who also should be acknowledged, consulted for their concerns, and soothed. Once charmed, these members of his own party, the opposition, and powerful outsiders can then be enticed into coalitions that later must be constantly created, recast, and then recreated issue-by-issue.

Shrewd Implementation

Finally, a successful administration must see to the implementation of its agenda. Once priorities are selected, new policies must be designed and announced at the inauguration. Soon thereafter programs must be sent to Congress, and the coaxing, cajoling, and logrolling that characterize presidential-congressional negotiations begin. As noted previously, all administration initiatives cannot be enacted during the transition. Yet, if the administration is to retain the initiative, new policies must be announced and subsidiary programs enacted in the nascent months of the transition.

Overall, nimble governance and shrewd implementation are necessary elements for successful transitions and are crucial components for the entrepreneurial presidency. An entrepreneurial or creative attitude towards transitions and to the office of the presidency combines politics, policy, and administration. The term "entrepreneurial" clearly describes the necessity for newly elected presidents to govern and take risks for later "profit" or success in the ongoing negotiations of the presidential enterprise. Thus, governance and implementation require cold-blooded politics that forgoes inordinate concern for specific individuals, issues, and policies which might become an impediment to the incoming administration. Presidents must protect their reputation in order to provide effectiveness and freedom for maneuvering in the political arena. They must not squander these assets by protecting friends, advocating for issues not yet ready for action, or blindly promoting policies advocated by electoral allies.

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The true mettle of the entrepreneurial presidency is the ability to channel the nation's mood while dealing with both political proponent and opponent. A non-threatening public style is crucial to success in the Byzantine maneuvering that characterizes workaday Washington. Thus to be successful, the entrepreneurial presidency must be wrapped in an aura of authoritative competence and reassurance for easy acceptance by both national elites and mass publics. Another key to successful transitions in a federalized democracy is the reputation, prowess, and political savvy of the president himself. Since he is the sole individual held accountable by the electorate for the national well-being, his agenda is the focus. Successful policy initiatives which are also effectively implemented in this most disaggregated and intransigent political system are precious and, as such, to be celebrated by all.

Domestic and foreign issues define the criteria (i.e., nimble governance and shrewd implementation) through different lens. Unquestionably, these realms require different levels of experience and confront new presidents with quite dissimilar demands. In the very complex arena of national security or foreign policy, continuity would seem to be warranted during the transition. On the international stage, the number of actors to be engaged is much greater than in domestic affairs. The subtleties and nuances of diplomacy are esoteric. Furthermore, the history and precedents of relationships with other nations and the many U.S. alliances are so extensive that any adjustment must be approached with the greatest consideration and care. In domestic affairs the difficulties of movement are as great, but the pressures, the actors, the coalitions, and the precedents already set are more accessible and intelligible to incoming presidents and their administrations.

Since the president and his advisers have, after all, been campaigning throughout the nation during the preceding months, domestic issues are better understood. For most presidents,

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foreign policy is indeed foreign and often inchoate at the beginning of the presidential administration. Yet in the end, new policies must be initiated in both the foreign and domestic arenas during the transition or the president is likely to be overwhelmed by the priorities of those outside the White House (Light, 1983).

To summarize, successful transitions require an entrepreneurial approach on the part of the president. Entrepreneurial presidents in democratic political systems are effective national leaders, a blend of the nimble lion and the shrewd fox, both carefully coated with a benign, puppy-dog-like exterior (Burns, 1956; Walker, 1993). We now focus on one specific presidential transition.

ASSESSING A PRESIDENTIAL TRANSITION

Having established these criteria, we will illustrate some insights we were able to draw by briefly applying them to the Clinton transition. This presidential transition exemplified interparty change as Clinton's administration succeeded twelve years of Republican Party control of the executive branch. We will seek to assess this transition in terms of nimble governance and shrewd implementation. We will also consider whether we found a leader who managed to be a lion, a fox, and a puppy dog.

The Clinton Transition

Bill Clinton assumed the mantle of president-elect in November 1992 after defeating the soon-to-be one term President George H.W. Bush. The election had been a hard fought contest between three major contenders (H. Ross Perot was the first credible, nationally-accepted, third-party candidate in decades) and had revolved around issues of the economy and jobs. The United States was beginning to emerge, unknown and unfelt at the time, from a recession and

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there was a national debate over the wisdom of entering into a free trade agreement with Canada and Mexico.

Unlike most previous presidents, Clinton could claim no mandate to establish a different course for the nation as he had won only 43% of the popular vote; and, yet, he was well positioned to be able to implement the policies on which he had campaigned since the Democratic Party controlled both the House of Representatives and the Senate. As noted by historian John Burke, Clinton had “an obvious skill in ‘campaigning for policy’” (Burke, 2000: 6). Thus, the Democrats were eager for Clinton to set the agenda for the nation and he appeared ready for the challenge of directing legislative victories after having run such a disciplined and focused campaign.

The promise of a new direction being orchestrated by a Democratic president was quickly tempered by the numerous missteps of the president-elect. The missteps were so frequent and so public that his transition is generally viewed as undisciplined and unfocused (Burke, 2000, 2001, Kumar, 2008, Maranto, 2004). In examining presidential transitions, Burke noted that the “Clinton presidency did not hit the ground running; it stumbled out of the blocks in worse shape than any modern presidency. Even Jimmy Carter looks accomplished by comparison—no small feat” (2000: 6). The evident chaos of the transition lacked both political nimbleness and shrewdness and was saved only by the grace of the honeymoon period that all new chief executives are fortunate to experience.

The Cabinet and White House Staff

Determined to have a cabinet that reflected the diversity of America, Clinton and his small inner circle concentrated on the selection of his team. The heavy focus on his cabinet officers detracted from any deep thinking about the players and processes that he would employ

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within his own White House staff to achieve his legislative priorities. Clinton even acknowledged in his own autobiography that he hardly spent any time on White House staff member selection (Clinton, 2004) and the *New York Times* observed that the “skeletal transition board has only met twice and is still trying to work out a time-table to present to Mr. Clinton for his most important transition decisions” (Friedman, 1992).

The lack of engagement with the organization of his staff was most obvious with the procrastination in naming a chief of staff. With the election decided November 3, it was not until mid-December that he announced that Mack McLarty would serve in the position. A childhood friend of unquestionable loyalty, McLarty would prove to be ill-equipped to handle the complexities of operating within the political sphere of Washington, D.C. His inexperience as a staff member (he was a *Fortune 500* company CEO), combined with his lack of political insight, and desire to play the role of honest broker impeded his ability to effectively control and direct the White House staff and serve Clinton. The selection of such a poor choice as chief of staff reflected directly on the president-elect's haphazard decision-making style. Even with his chief of staff in place, Clinton procrastinated further on selecting members of his White House staff. It was not until five days prior to the inauguration that Clinton named his senior staff members, which resulted in no one being familiar with their new positions or having the opportunity to ask their outgoing predecessors questions (Kumar, 2008).

Though he did overlook the value that his own staff would bring to the success of his legislative agenda, Clinton's intense focus on building the best cabinet possible did not materialize as expected. Early successful decisions quickly morphed into bad choices. Richard Riley, the former governor of South Carolina, was placed in charge of personnel operations and Warren Christopher, a trade negotiator for Kennedy and State Department official for Carter,

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was selected as the transition director. By naming his personnel director as secretary of education, he may have made a shrewd decision for the cabinet position; however, the choice hampered the nascent administration's ability to prepare itself to govern (Maranto, 2004). Burke quotes one transition staff member stating, "The personnel process was a complete disaster. They put Dick Riley in charge of it and then named him secretary of education. And he immediately moved out of it, and that deteriorated into a complete mess; it was just chaos . . . there were no real people with experience running it" (Burke, 2000: 295).

The problem of preparing to govern was exacerbated when Warren Christopher was named to fill the secretary of state position. Both men removed themselves from their transition jobs while the administration was still in transition in order to prepare themselves for their Senate confirmation proceedings.

Clinton wanted a cabinet that reflected the diversity of the United States, from both a gender and a racial perspective; and, it was in his next cabinet selections that he experienced the first true scandal of his administration, thereby creating turmoil even before being sworn into office. Women's rights groups agitated for a woman to be selected for one of the big four cabinet positions (i.e., State, Defense, Justice, and Treasury). Clinton announced his cabinet secretaries along with appropriate counterparts in various councils (e.g., Secretary of Defense with members of the National Security Council). As he named his state department team, defense department team, and economic team with men all taking the secretary positions, the pressure was increased on Clinton to name a female to be Attorney General. In selecting his Attorney General, Clinton was neither shrewd nor nimble.

When his first choice, Zoe Baird, was named as Attorney General-designate, many perceived that Clinton was a weak executive who could be pressured into making particular

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decisions (Burke, 2000; Drew, 1994). The supposed weakness, however, paled as Baird's nomination ran into a political firestorm over her employing an illegal childcare worker and family driver. Not only were the two employees illegal immigrants, but she had failed to pay social security taxes on their salaries. Clinton's team did not appreciate the political sensitivities that would arise with the revelation. The political tide was turning against his nominee, yet he refused to withdraw her name and only relented the day after his inauguration when Senate Democratic leaders informed him that she could not be confirmed (Drew, 1994). George Stephanopoulos recognized the administration's lack of political sensitivity as he commented on the Baird nomination, "We should have never let Baird's nomination get as far as it did, but our systems failed us at every crucial step" (Stephanopoulos, 1999: 118).

Unfortunately, new systems proved little better when in early February, Clinton's team leaked to the press that Kimba Wood, a federal district court judge, was the new nominee for Attorney General. Realizing that Wood's similar problem with an illegal immigrant as a childcare worker would generate a new firestorm, President Clinton withdrew her nomination. Regrettably, the administration had again demonstrated a lack of political sophistication evidenced by a successful entrepreneurial president. Reviewing Clinton's first hundred days in office, a *New York Times* editorial likened the search for an attorney general to being "snakebit" (*New York Times*, 1993). The President did not have his attorney general sworn in until March 12, 1993 when Florida State Attorney General Janet Reno finally took the oath of office.

The search for a confirmable attorney general was not Clinton's only evidence of political blindness. A holdover from President George H.W. Bush's administration was directing the department; Webb Hubble, a former law partner of Hillary Clinton was slated to be the number two administrator in the Department of Justice and his confirmation was arduous.

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He noted that, “the media began focusing on what they called a leadership vacuum at Justice” (Hubbell, 1997: 185).

A few months into the administration, another appointment political crisis erupted. Lani Guinier was nominated to be head of the Civil Rights Division of the Justice Department. A law professor, she had written academic articles concerning racial discrimination. The articles proved to be controversial and she was dubbed the “Quota Queen” by the *Wall Street Journal*. After the controversy erupted Clinton read the controversial articles for himself, felt he could no longer support her nomination, and withdrew it. Senator Joe Lieberman, a Democrat from Connecticut, reflected on the haphazard vetting of Clinton's nominees by his White House staff and stated, “If they didn't know [about her academic articles], they did a bum job of review. If they did know and didn't stop the nomination, their judgment is off” (Drew, 1994: 206).

The Clinton Agenda

Though he stumbled badly during his transition period, Clinton had reassured the nation that he would remain focused on the agenda on which he campaigned. He created the National Economic Council and announced it at a December press conference. Shortly afterward, in mid-December, he held a two-day economic conference that demonstrated his attention to the U.S. economy. Citizens wanted the new president to succeed and shortly after assuming the office his poll numbers revealed 58% approved of his job performance (Kumar, 2008).

Clinton's agenda was broad. Reviving the economy was his primary focus with both a stimulus and deficit reduction program to be proposed. He intended to comprehensively reform health care—a plan would be before Congress within the first hundred days. Welfare would be overhauled. He would present to Congress a college-loan and the AmeriCorps community-service proposals. Vice-President Gore would organize and propose to Congress a reinventing

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government program. Clinton also proposed community development banks and enterprise zones. But he failed as an entrepreneurial president in that he did not focus on a few major projects and not try to do everything in his first year. During the transition period Bruce Lindsey, a Clinton advisor, noted that, "We had no time line before we came in. No one sat down and said, 'if you do A, B, C is your plate too full?'" (Drew, 1994: 36). At the hundred day mark, some in Clinton's administration were questioning whether far too much had been heaped onto the legislative plate (*New York Times*, 1993).

Thus he lacked the shrewdness to ensure that nominees were picked early and were confirmable; he also did not have the nimbleness to avoid blunders in his public comments. A campaign speech to allow homosexuals to serve in the military had drawn little interest. That changed when a reporter asked Clinton if he intended to work on changing Defense policy now that he was president. Clinton was not well briefed on the issue and his not offhanded comments alienated vital constituencies (Mathews, 1993). What ensued were weeks of negative political coverage. The controversy became so heated that the Chairman of the Joint Chiefs of Staff advised that if military officers found the plan morally unconscionable, they should resign. Congressional ire increased and it became apparent that Congress was on the verge of passing legislation to override any executive order Clinton might issue.

Thus Clinton's poorly staffed comments, in the first month of his administration, generated a crisis in civil-military relations. To defuse the situation, Clinton referred the issue to his Secretary of Defense, Les Aspin, to study for six months. The new policy of "Don't ask. Don't tell." quieted the furor but no one was satisfied, and Clinton had once again demonstrated that he was not well attuned to political sensitivities. William Waybourn, director of Victory Fund, a political action committee raising funds for gay and lesbian political candidates,

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commented on the ill-timed and needless distraction of the subject, "The whole issue was very costly. Basically, it took a new administration and dropped it on its head for three months . . . And what did we have? Nothing" (Yeager, 1993: 205). As a result of these controversies, Clinton lost 20 points in his favorability rating in the first two weeks of his presidency (Drew, 1994).

The new President did demonstrate some adroitness in his actions. Having campaigned on reviving the economy, he wanted his budget to set a new path. Clinton sought to accomplish three things with his first budget: (1) a stimulus program, (2) human capital investment, and (3) a deficit reduction program. Poor legislative liaison with the Senate resulted in the stimulus dying as the White House felt no need to accept a moderate compromise with Republican Senators, especially after the plan had passed the house (Stephanopoulos, 1999). Jobs training and education essentially met the same fate when Clinton learned that a 1990 legislative budget agreement had established spending caps through 1995 so he was limited to less than a paltry \$1 billion (Reich, 1997). Yet, he was able to steer his \$1.5 trillion budget outline through in record time, and it passed in August, even though it required Vice-President Gore's tie-breaking vote in the Senate after squeaking through the House 218-216.

A notable legislative accomplishment that his team was able to steer through the House and Senate was the Family Medical Leave Act. Unfortunately, the Kimba Wood nomination had cratered, and Wood's statement to the press was released the same day as Clinton was to sign the FML Act into law. Clinton's successes were too frequently, in his inaugural year, overshadowed by his stumbles. His administration demonstrated little of the adroitness observed in his campaign when it had faced a challenge.

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Clinton's political judgment continued to be questionable through his first year in office in both small and great matters. A \$200 haircut onboard Air Force One as the aircraft sat on the Los Angeles International tarmac reportedly delayed other planes and generated another firestorm that had nothing to do with Clinton's ability to govern. The campaign promise to reduce the White House staff by 25% became an embarrassment as Clinton's team was unable to accurately determine how many people worked on the staff and then indicated that it might not be achievable at all. The reductions that were attempted had the appearance of ham-handed political firings such as the 20-person reduction in the White House correspondence unit and wholesale firing of the White House travel staff. One success for Clinton was the passage of the North American Free Trade Agreement. Opposed by a majority of Democrats, Clinton only succeeded in getting the bill passed with Republican support. Though he had campaigned as a "New Democrat," questions arose about how successful a president could be who worked against his party.

The minor embarrassments paled in comparison to the political missteps on one of his signature campaign efforts—comprehensive health care reform. Originally, the proposed legislation was to be presented to Congress by May. The complexity of the health care reform led to the date slipping to July, and then it slipped again to September. The decision to place his wife Hillary Clinton in charge of the reform effort was not well received by all legislators and the perceived poor efforts to keep Congress informed further alienated members. Eventually, the health care reform effort was put off until 1994. Like healthcare, welfare reform, which was on the agenda for 1993, had to be shifted to a later date.

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Conclusion: Not an Entrepreneur

Clinton did not display an entrepreneurial style in his first year in office. Even though he had some significant legislative victories his first year in office (e.g., NAFTA and FMLA), Clinton stumbled more than most of his predecessors. He was neither nimble in extricating himself from untenable positions nor shrewd in positioning himself to successfully sell his agenda to Congress or the American people.

His unfocused and undisciplined decision-style, commencing with the indecision in naming his chief of staff during the transition, would reverberate throughout his first year in office to his detriment. Clinton would gain a successful entrepreneurial footing only with the naming of a new chief of staff in 1994 and the takeover of both the House and Senate during mid-term elections that year, which forced the Clinton White House to find both discipline and focus.

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BACKSTAGE & A CUSTOMIZABLE RIBBON: NEW FEATURES IN OFFICE 2010

Session Organizers and Moderators

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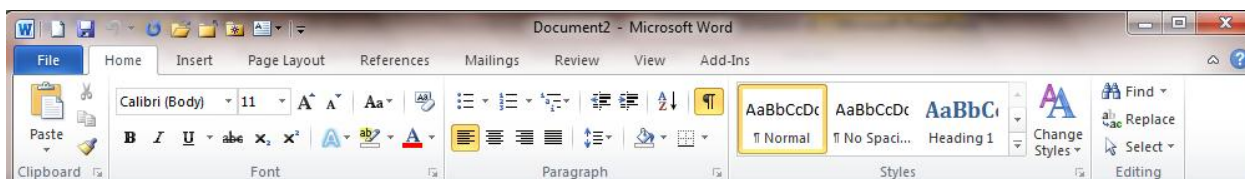
Abstract

Though the Ribbon User Interface had few changes from Office 2007 to Office 2010, there are many new features in Word, Excel and PowerPoint. Microsoft Office 2010's June 2010 release date kept many schools from adopting for Fall 2010 classes. Now with a new version to learn, schools want to know what the new features are and how they will impact teaching. This session will compare Office 2007 with 2010 and highlight what is new. The audience will be encouraged to participate in the demonstration and share their experiences in 2010.

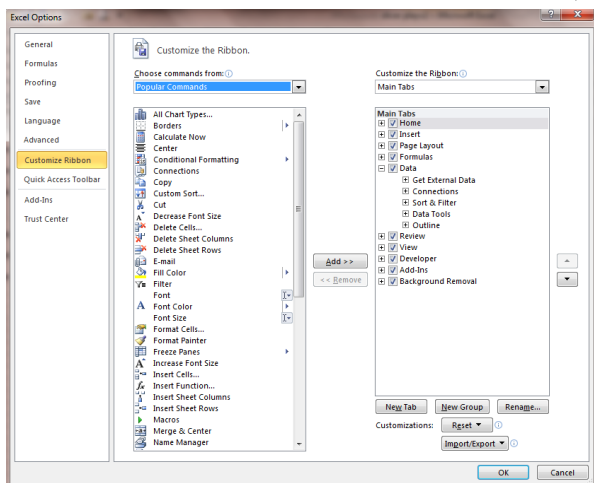
Session Overview

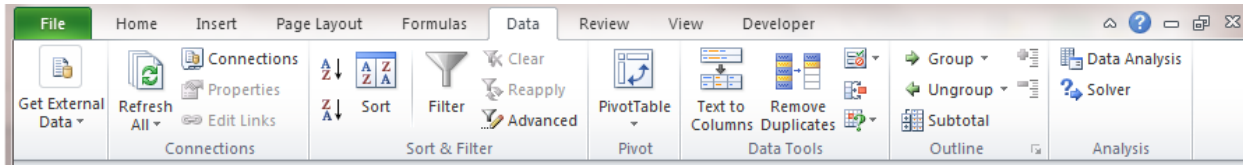
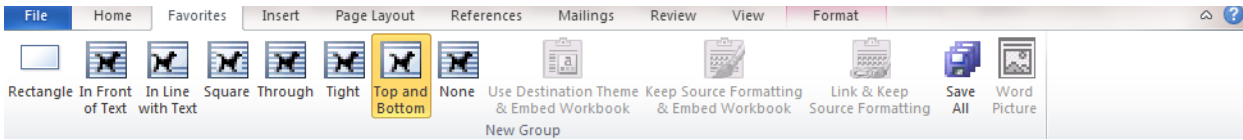
This session will show the features new to Office 2010 as well as discuss features shared with Office 2007. Below are samples of features to be included:

Office Ribbon with new File Tab

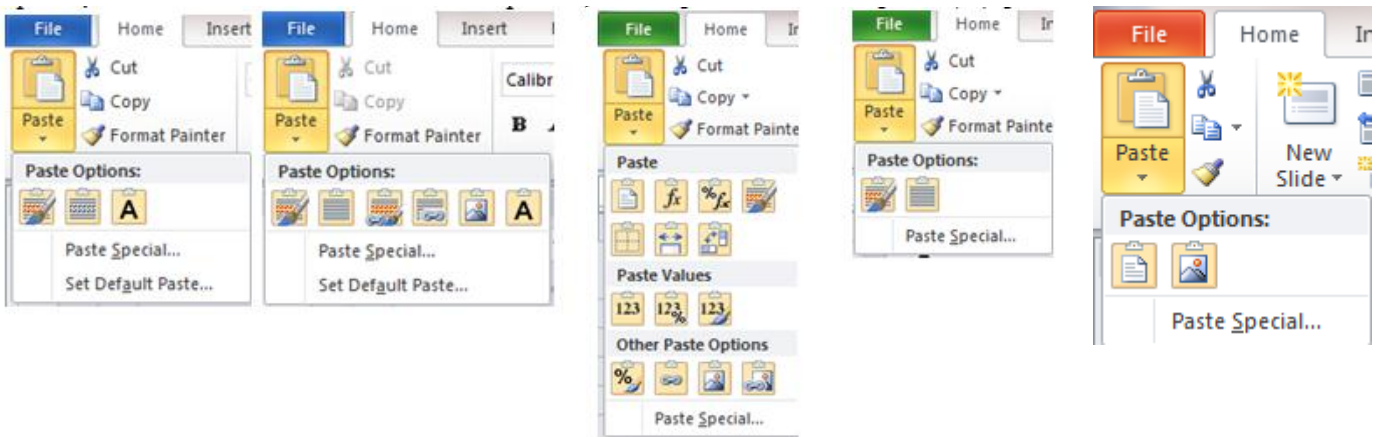


Customization of the Ribbon with new Tabs, Groups, Commands.

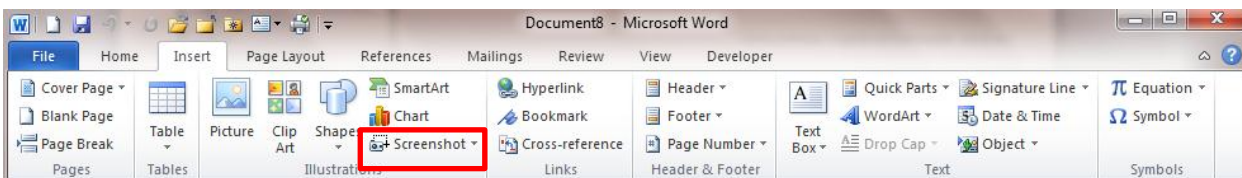




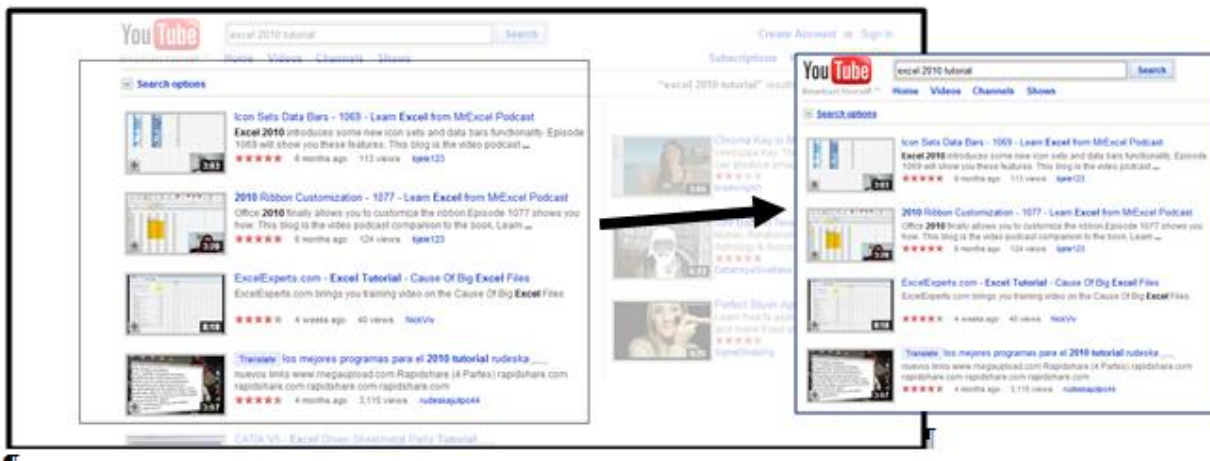
New Paste Functions – with Live Preview. Options vary with application and what is being pasted.



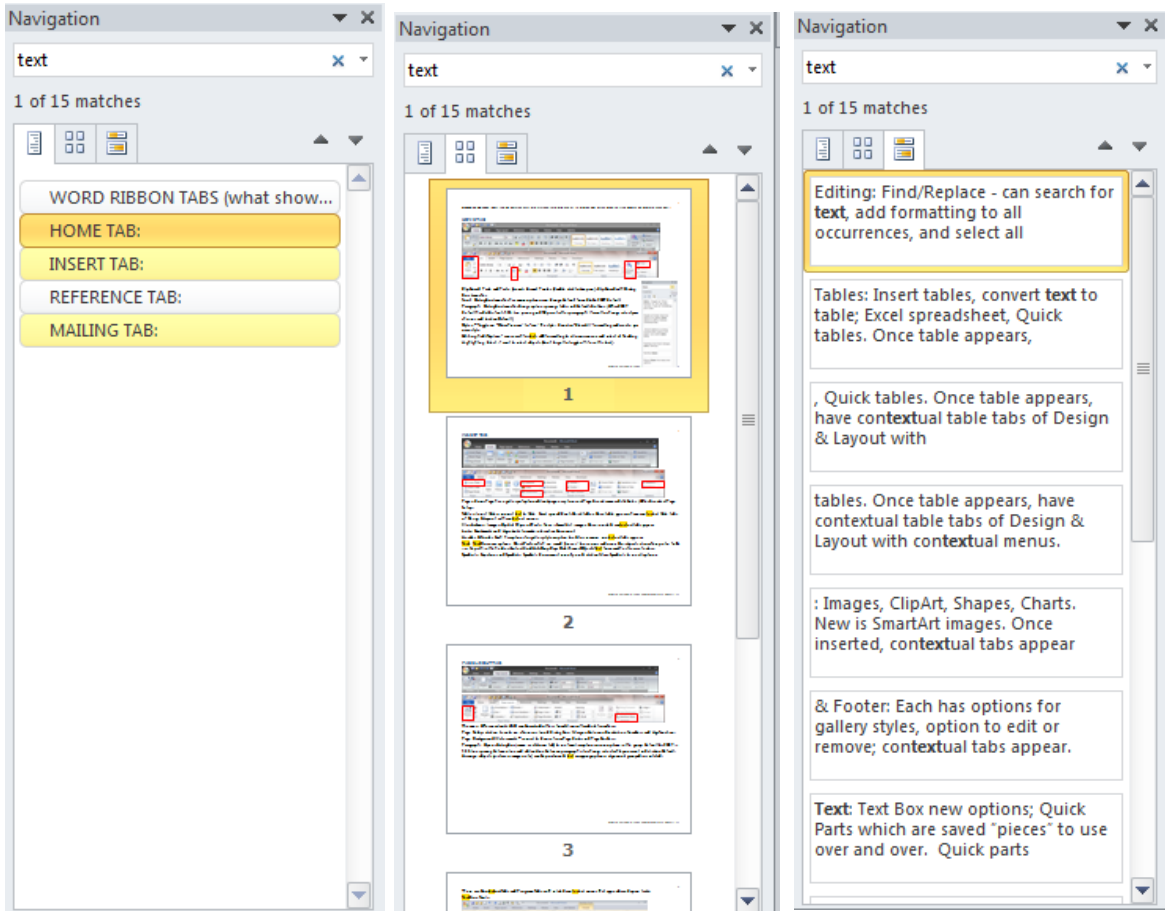
Screenshots – a feature that is a much better option that Print Screen and Alt Print Screen



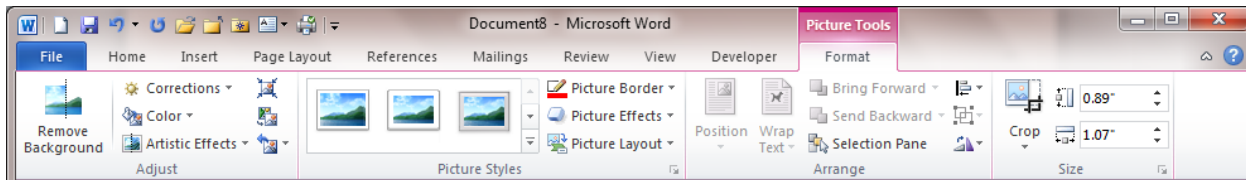
New



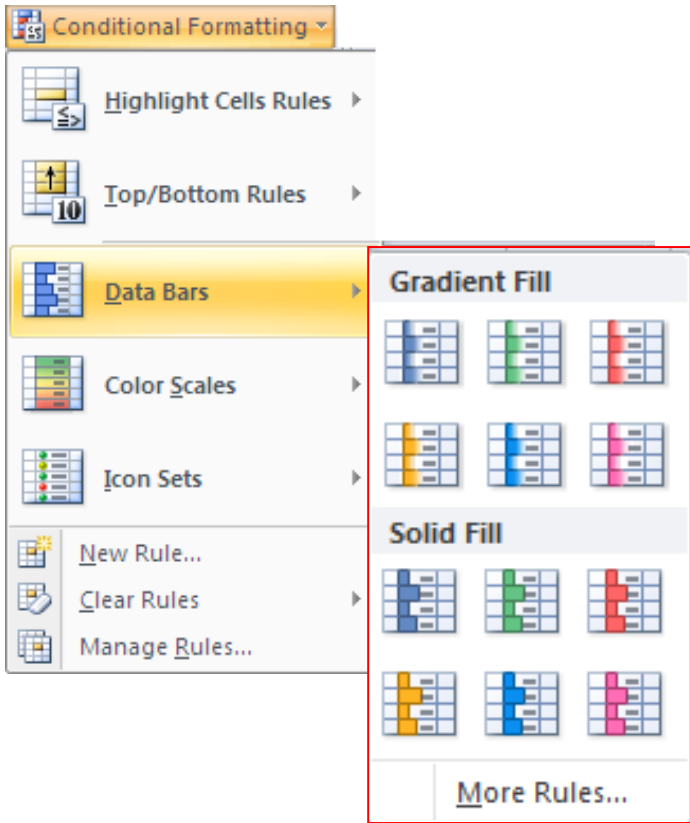
Navigation Pane – allows for moving of sections, browse pages using miniature page iamges, and search text showing all occurances of words.



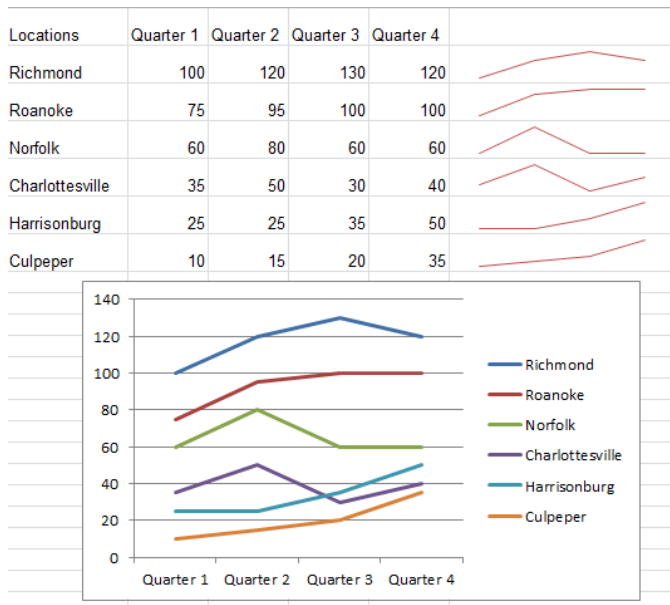
PowerPoint and Word – Remove Background of images at the Picture Tools Format Contextual Tab



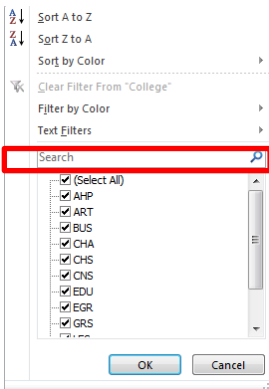
Excel has new Conditional Formatting Options at Data Bars, Color Scales and Icon Sets.



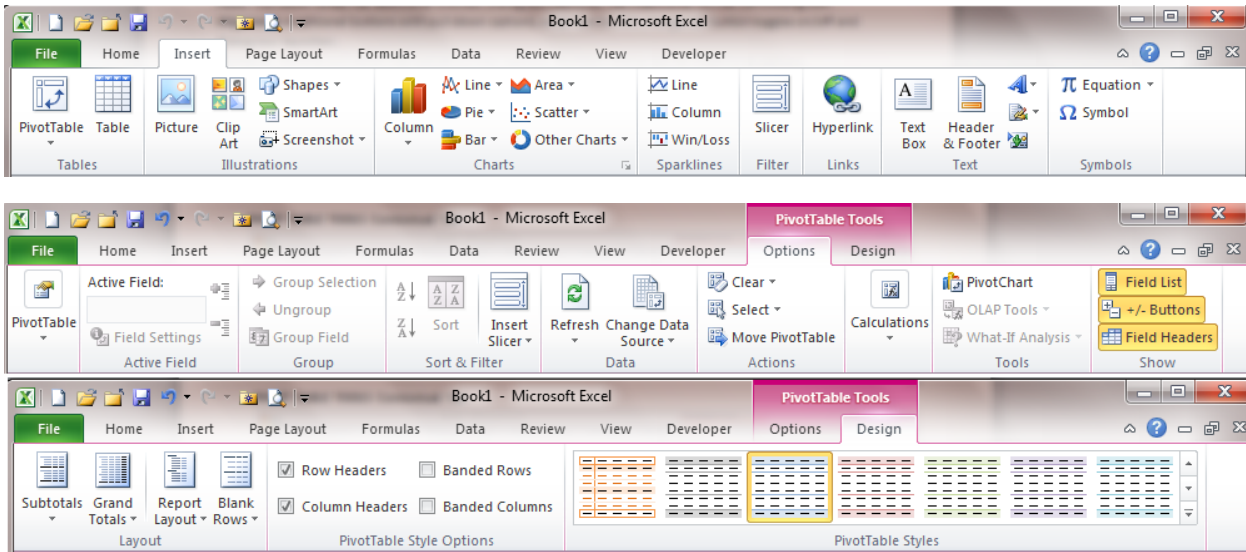
Excel Sparklines put in miniature graphs in individual cells, similar to what would be visually seen in a chart.



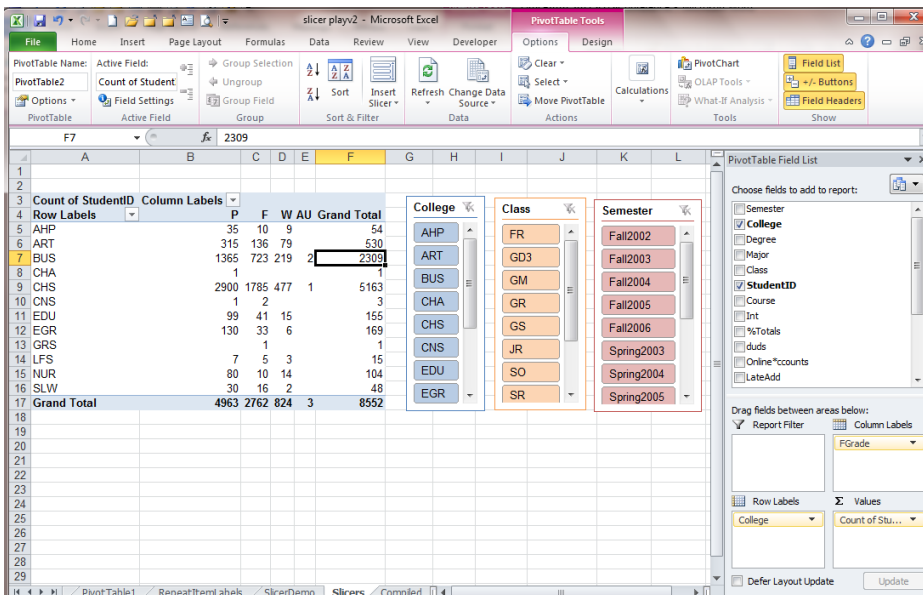
Excel Filtering now has a Search Option



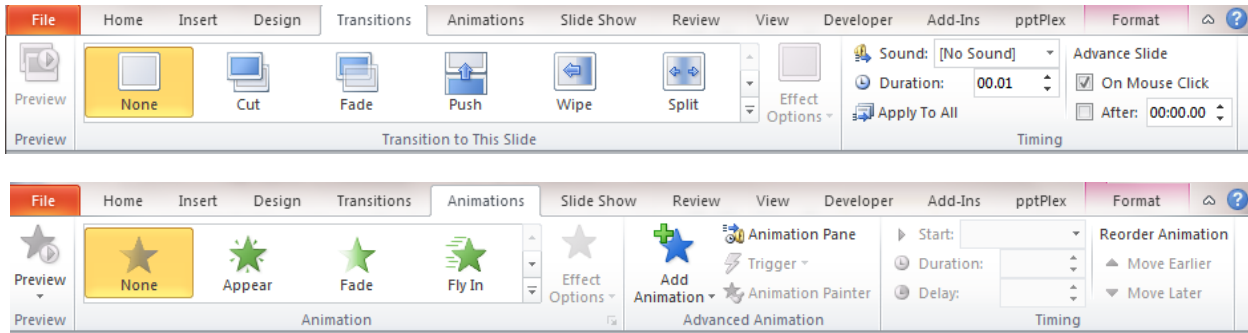
Insert Tab has new PivotTable features.



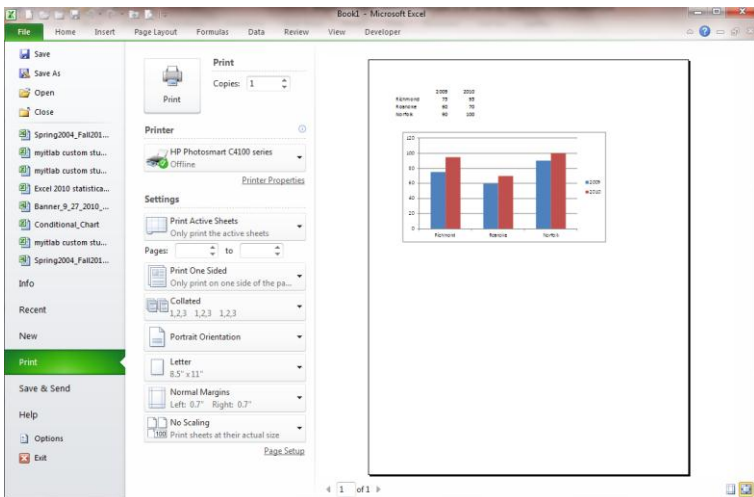
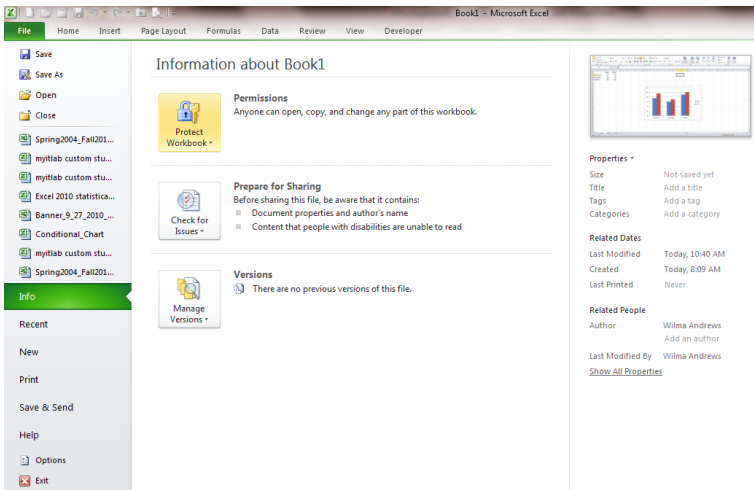
PivotTable Slicer allows for varied filtering options.



PowerPoint – now has individual tabs for Transitions and Animations.

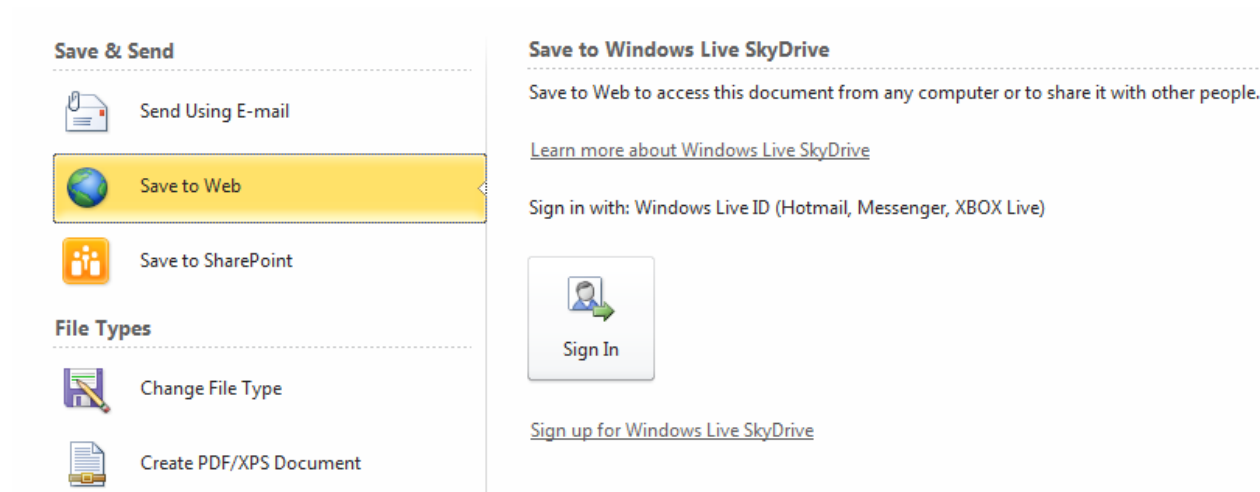


The Office Button is gone. The File tab leads to new Backstage features many of which were at Tools/Options in 2003.



With the release of Office 2010, Microsoft is promoting their new Web Apps to compete with Google Docs.

Web Apps



The image shows a screenshot of the 'Save & Send' menu in Microsoft Office 2010. The menu is divided into two main sections: 'Save & Send' and 'File Types'. In the 'Save & Send' section, the 'Save to Web' option is highlighted with a yellow background. Below it are 'Send Using E-mail' and 'Save to SharePoint'. The 'File Types' section includes 'Change File Type' and 'Create PDF/XPS Document'. To the right of the menu, there is a 'Save to Windows Live SkyDrive' section with a 'Sign In' button and a link to 'Learn more about Windows Live SkyDrive'. Below the 'Sign In' button is a link to 'Sign up for Windows Live SkyDrive'.

Save & Send

- Send Using E-mail
- Save to Web**
- Save to SharePoint

File Types

- Change File Type
- Create PDF/XPS Document

Save to Windows Live SkyDrive

Save to Web to access this document from any computer or to share it with other people.

[Learn more about Windows Live SkyDrive](#)

Sign in with: Windows Live ID (Hotmail, Messenger, XBOX Live)

[Sign In](#)

[Sign up for Windows Live SkyDrive](#)

**THE ASSESSMENT PROCESS AND IMPROVEMENTS THAT JUST DON'T
DELIVER: A CASE STUDY WITH EMPIRICAL EVIDENCE**

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Abstract

Assessment of course effectiveness in undergraduate programs in Information Systems is no longer an option. Accrediting bodies demand that processes be put into place to assess student achievement of course outcomes that can spot weak areas so that corrections can be made in the classroom. But even when a measurement indicates weakness, it does not necessarily provide guidance on the underlying source of the weakness, or how to “solve” it. This case study examines an assessment process used over several years. This paper describes attempts over time to “complete the cycle” of improvement by making changes and measuring again.

Background

Businesses today are increasingly reliant on technology and managers who understand how to make decisions about acquiring and using systems. Many undergraduate programs address this with an introductory course in Management Information Systems (MIS) for all students, regardless of their intended major. Virginia Commonwealth University uses this approach and has had a Business Information Systems course as part of its “core” business curriculum for over 20 years.

Initially a course to give students their first or near-first experience with computers, it was offered to students of all levels, and was encouraged at the freshman/sophomore level, since understanding the workings of computing technology was relatively independent of business knowledge. Over time, the content of the course has evolved as students enter college with greater prior exposure to computers and software. This evolution is not unique to VCU.

Research verifies the shift in emphasis from purely technological topics toward more business-focused and applied technology areas [5] [3]. Accrediting institutions acknowledge this; e.g. AACSB includes in their *Eligibility Procedures and Accreditation Standards for Business Accreditation* (2010) Standard 15 [2], a more management-oriented learning requirement:

Information technologies as they influence the structure and processes of organizations and economies, and as they influence the roles and techniques of management. “

Also evolving over time is the need for undergraduate programs to measure how well they are meeting program objectives related (but not limited to) student learning about technology in order to spot weaknesses and make appropriate interventions. This is emphasized in AACSB standard 15:

The school uses well documented, systematic processes to develop, monitor, evaluate, and revise the substance and delivery of the curricula of degree programs and to assess the impact of the curricula on learning.

A similar requirement comes from ABET, Inc., which accredits programs in computing technologies, such as the Information Systems program at VCU which is responsible for the introductory IS course. Criterion 4 of the *Criteria for Accrediting Computing Programs* (2009) [1] states that the program must use:

... a documented process incorporating relevant data to regularly assess its program educational objectives and program outcomes, and to evaluate the extent to which they are being met. The results of the evaluations are documented and used to effect continuous improvement of the program through a documented plan.

With an eye toward addressing accreditation concerns of both institutions, VCU faculty have gone through several cycles of “process improvement” directed toward the introductory IS course.

The assessment process

The first challenge was to develop a measurement tool that could be easily administered and enforced across many sections of the course, most of which are “large” sections with over 100 students. The faculty had ample anecdotal evidence that the student experience and level of learning in the course could vary widely depending on the instructor and text used. Since the first step in improving a process is to define and standardize it, the faculty reached a consensus on a list of 9 areas that must be covered in all sections of the course. These 9 areas include topics that contribute to the core business curriculum as outlined in AACSB Standard 15, and to program outcomes outlined in Criterion 3 of the ABET *Criteria for Accrediting Computing Programs* (2009) [2]. The 9 areas are:

1. Computer Hardware
2. Computer software
3. Databases

4. Networks & communication
5. The Systems Development Life Cycle
6. E-Business
7. Organizational Information Systems
8. Security/Business continuity
9. Ethics and Privacy

To make sure that the 9 areas were covered and to provide the measurement tool needed for on-going assessment, the faculty decided to develop a “common exam” to be used in every section of the course. Instructors have the option of using the exam alone or along with their own assessment items, and can weight the exam’s impact on final grades in any reasonable manner they choose.

The exam items were developed by the four instructors actively engaged in teaching the course. Each instructor developed a small set of 3 or 4 items for each topic. They then collaborated on choosing the most appropriate 5 items in each area for the final version of the exam. Additional items were included for the SDLC topic to provide more focus on the AACSB learning standard. This collaborative effort tried to identify questions that were not book-specific, i.e. not based on specific cases or language used in a text. This was done so that the questions could be reused even with changes in the text or new editions. An initial level of acceptable overall student performance for the course based on the results from each of the 9 areas. The goal was for at least 70% of the students to get at least 70% on the question set for each topic.

Improvement Cycle 1 2004-2005

The initial exam results showed that student performance overall was at an “unacceptable” level, and while problems were noted in the hardware, database, networks & communication and E-business content areas, the glaring deficiencies were in the SDLC and organizational information systems topic areas with scores of 54.9% and 52.7% respectively. The students were not performing as well on these items compared to the other areas, or to the program goal. A summary of the results are presented in Table 1.

Table 1: Results 2004-2005

Content Area	% Students Receiving Acceptable Score (70% receiving 70%)
Hardware	65.5%
Database	64.9%
Networks & Communications	68.8%
Organizational Information Systems	54.9%
SDLC	52.7%
E-Business	65.0%
Overall Average	66.5%

After much discussion among the faculty, it was decided that a “root cause” of the poor performance in these areas relative to the others was the students’ lack of exposure to the business context of the material. AACSB accredited programs are required to offer the majority of the “business core” only in upper division courses. Historically, this course had always been open to certain freshmen, and student advisement encouraged sophomores to take it. This is not an anomaly in business schools – research indicates that 30% of AACSB institutions offer the introductory course at the sophomore level [4]. As noted in an annual report prepared by the faculty on the assessment results:

The reason offered for the poor overall score by students in the Systems Development Life Cycle content area is that students enrolled in the introductory IS course, have a limited understanding of business foundations, also do not have well-developed problem solving, and analytical skills. A significant part of understanding the systems development process is having the ability to think abstractly and model this abstraction into a solution that describes data and information requirements necessary to meet business needs. Students have not experienced a sufficient number of [core] courses that present business needs in terms of data and information that require them to use analytical and creative problem solving techniques. Students have difficulty understanding the flow of information through an organization since most of them have not been exposed to a real business work environment where they have been given the responsibility of knowing what is required to perform different job tasks.’

The first “improvement cycle” included restricting the course to sophomores, and then to juniors. It was felt that giving the students the time to complete some business courses would bring to the course students with a greater awareness of, and interest in the business environment. In addition, supplemental materials on organizational information systems and SDLC would be used in classroom instruction to supplement the textbook coverage.

Table 2: Results 2005-2006

Content Area	% Students Receiving Acceptable Score (70% receiving 70%)
Hardware	58.8%
Database	64.9%
Networks & Communications	69.0%
Organizational Information Systems	54.4%
SDLC	53.9%
E-Business	67.7%
Overall Average	65.6%

Improvement Cycle 2

Since the elevation of the level of prior business knowledge did not have the desired results, the faculty decided to try an alternative approach. Instead of modifying the profile of the students in the course, the faculty decided to modify the course content by mandating a text across the sections that was more business focused; i.e. one that had fewer chapters/pages devoted to the technical aspects of computing like hardware, software, and communications devices, and more on how organizations and societies used information systems. The final exam items were not changed significantly. The technical topics were still covered. What changed was the relative amount of time and attention spent on the topics. The results summarized in Table 2 indicate that overall, student performance dropped as well as the content areas receiving unacceptable scores either remained relatively the same or increased slightly, or dropped slightly. These results were extremely disappointing since faculty had made the extra effort in improving instruction, especially in the areas of organizational information systems and SDLC.

Action plans included an effort to use small cases that reflected the principles incorporated in the learning objectives, with the primary focus on organizational information systems. News reports from local and national media were discussed in classes to engage the students more in these topic areas. Assignments were aimed at having students relate their major area of study to the content area being covered in class discussions and textbook coverage of the subject area.

Cycle 2: Results 2006-2007

The change had an impact on the performance measures for the organizational information systems and SDLC content areas although both remained at the “unacceptable” level – only 61.1% and 62.6% of students respectively received a weighted score of 70% or better as reported in the Fall 2007 assessment report for the course. Table 3 below provides a summary of the content areas that were still ‘unacceptable’ performance levels. The one bright spot was the networks and communication area’s improvement to 70%, which although a minimum score, now was in the ‘acceptable’ range. Student overall scoring was improved to 68.7%, an increase of 3.1%, a significant improvement. Faculty members teaching these sections of the introductory course were encouraged with the improving scores.

Table 3: Results 2006-2007

Content Area	% Students Receiving Acceptable Score (70% receiving 70%)
Hardware	64.7%
Database	67.7%
Organizational Information Systems	61.1%
SDLC	62.6%
E-Business	67.7%
Overall Average	68.7%

Improvement Cycle 3

The 2009 Assessment report included a set of initiatives to respond to the decreasing trend of scores for the Organizational Information Systems content area and the continued lackluster performance for the SDLC content area. The following recommendations were made:

- A. Continue to use a textbook that provides a business orientation to information technology and systems and their role in organizations. The textbook should focus on the essential concepts that business students need to complement their major area of study.
- B. Use more case studies and outside material to improve the students' understanding of the significance of organizational information systems applications in the success of organizations; and
- C. Experiment with different pedagogical approaches to engage students in and outside the classroom.
- D. Conduct an assessment in the Strategic Management capstone course to determine if students who have completed the core business school courses can achieve an acceptable score on IT/IS in organizations and SDLC content areas assessment. This follow-up assessment would provide a means for determining whether students who have completed all the principles courses in the business core have a better understanding of how information systems can provide organizations a competitive advantage.

These initiatives were implemented hoping that assessment scores would improve significantly. However, the 'Acceptable' outcome performance score dropped again. The conclusion appears to further the notion that students are unable to discern the fundamental business processes or functional-area management principles to understand the impact and significance of IT & IS in creating a competitive advantage for the companies used in the case studies. In a further note, the follow-up assessment did not provide evidence that students understand the role of information systems in organizations or the importance of the systems development methodology for building organizational information systems. In an interview with a senior faculty member teaching the business capstone course, to paraphrase his opinion of why students maintain an 'Unacceptable' level of knowledge in the role of information systems is that "...students still do not understand the fundamentals of business processes...even after completing their core business requirements." This is perhaps a fundamental flaw in the core curriculum that needs to be addressed.

Cycle 3 Results

The latest statistics from the common exam, which should reflect the results of the latest interventions, are not encouraging (Table 4).

1. Four of the 9 content areas received a rating of ACCEPTABLE where the scores are greater than the target score of 70% for a rating of acceptable.
2. Five of the 9 content areas received a rating of UNACCEPTABLE where their weighted scores are less than the target score of 70% for a rating of acceptable. The 5 content areas

which did not score at least 70% were *Organizational Information Systems, Systems Development Life Cycle (SDLC), Networks & Communications, Security & Business Continuity, and Computer Software.*

3. The overall weighted average score for the sample of 264 students tested was 67.4 %; an UNACCEPTABLE level of overall class performance.

Table 4: Results 2007-2008

Content Area	% Students Receiving Acceptable Score (70% receiving 70%)
Software	65.0%
Networks & Communications	64.8%
Organizational Information Systems	53.4%
SDLC	58.3%
Security & Business C	52.6%
Overall Average	67.4%

The weighted average score of 53.4% for the content area Organizational Information Systems has continued to fall progressively lower in the previous three annual assessment reports. The Fall 2007 assessment score was 61.1%; the Fall 2008 assessment score was 58.9%, and the Fall 2009 assessment score was 55.2%, showing a steady decline in scores by almost 7.7% since 2007. The SDLC content area fell to 58.3%, another disappointment.

In a departure from previous assessment results, three content areas that had been receiving ‘Acceptable’ scores have dropped to a level of ‘Unacceptable’. Of the five problem content areas notably there are three: Networks & Communications @ 64.8%, Computer Software @ 65.0%, and Security & Business Continuity @ 52.6%. These content areas have a technical information systems orientation, which was de-emphasized by the choice of text in order to improve scores on the management-oriented content areas.

Recent Action Plans:

Based on the assessment results, the following actions are planned for addressing the non-achievement of the performance levels for the underperforming content areas

- A. Review of the nine content areas to determine if these content areas should continue to be used in developing the course assessment instrument or a revision of the content areas to be incorporated in the assessment instrument. The content area “Organizational Information Systems” is to be changed to “Role of Information Systems in Organizations” to more accurately describe the principles that are needed to be assessed.

- Examine other information systems program assessment measurement techniques to validate the viability of the current approach of assessment.
- B. Supplement the systems development (SDLC) content with business process modeling concepts and real-world examples using material from sources other than the textbook. Continue to use a textbook that provides a business process orientation to information technology and systems and their role in organizations. The textbook should focus on the essential concepts that business students need to complement their major area of study.
 - C. Enforce two one-credit courses in computer literacy as prerequisites. Computer literacy is listed as pre-requisite knowledge, but there has been no way to verify that students have this knowledge without having them take the courses. Most students do not do so, assuming that they are “computer literate” because they can tweet and type into a word processing document. However, the literacy courses include an introduction to hardware, software, communications and the internet – some of the same technical concepts areas that appear to be weakening in our assessment results. These requirements would establish that all students have an initial understanding of this material before taking the course.
 - D. Evaluate alternative approaches for content assessment (e.g., embedding of questions, pre/post survey) for possible adoption. Review assessment techniques being proposed by textbook publishers.
 - E. Explore and evaluate different pedagogical approaches that show potential for engaging students at a level that encourages a greater degree of learning such as small-in-scale, real world outside case projects. Develop assignments that will engage the students at a more personal level which they can relate to more easily and from which they can derive an appreciation for the IS and IT issues in an organizational context. An example might be the task of determining user and system requirements for a familiar business application that depicts recognizable business processes perhaps in a mobile context.
 - F. Embed and integrate the assessment questions in tests throughout the course of the semester and test again through a comprehensive assessment instrument at the end of the course to measure content retention and understanding.

Conclusions

This case study shows that having measures and a formal improvement process in place does not imply that improvements will occur. Three attempts to improve learning outcomes have not only fallen short of their goal, but measured post-intervention results show a *decline* in learning in spite of the best efforts of the faculty.

Perhaps there is wisdom in moving the course to a senior level wherein students will have had an opportunity to mature more and will have completed most of the core business courses which would introduce them to the principles of the disciplines that focus on business process and the functional areas of business.

The authors are open to suggestions from other faculty members who have had greater success in teaching students organizational information systems and SDLC.

Table 5: Summary Results for Overall Course Assessment (%).

	HW	SW	DB	Ethics & Privacy	NetWk Comm.	Org. Sys.	Systems Develop	E-Bus.	Sec & Bus Continuity
Percent of Students who received 'acceptable' scores	80.4	65.0	74.6	79.8	64.8	53.4	58.3	77.8	52.6

References:

- [1] "Criteria for Accrediting Computing Programs: Effective for Evaluations during the 2009-2010 Accreditation Cycle", ABET, Inc. Baltimore, MD. Available at : <http://abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/C001%2009-10%20CAC%20Criteria%2012-01-08.pdf>
- [2] "Eligibility Procedures and Accreditation Standards for Business Accreditation", AACSB International, Tampa, FL 2010 available at: <http://www.aacsb.edu/accreditation/AAACSB-STANDARDS-2010.pdf>
- [3] Stephens, C.S. and O'Hara, M.T. "The Core Information Technology Course at AACSB-Accredited Schools: Consistency or Chaos?" Journal of Education for Business, March/April, 2001
- [4] Wang, S. "An Examination of the Introductory MIS Course" Journal of Information Technology Education, Vol 6, 2007.
- [5] Wynekoop, J. L. and Nakatani, K., "A shift in content of the IS fundamentals course". International Journal of Teaching and Case Studies, Vol 1, number 1/2 , 2007.

A Case Study of One Program's Journey through the Minefields of Assessment

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Abstract

The purpose of this case study is to develop a road map to assist other departments along the assessment trail. First we try to explain why we think assessment is important and how we have integrated assessment into our college and department. We then look at what we were doing for assessment. And finally we end by identifying the procedures we have implemented to make the assessment process as painless as possible.

Most universities have found themselves having to conduct assessment. Assessment is conducted for accreditation purposes and to determine if students are meeting learning objectives. This case study follows one MIS program's journey to set up a useful, sustainable assessment plan.

Where Do We Begin?

The Management Information Systems (MIS) program in question had an existing assessment plan. A few courses were picked each year and some objective from the syllabus was assessed. While this counted as assessment, the results were not very useful, and the faculty only conducted the assessment because they were required to. This type of assessment has been a problem in higher education, and the debate on how best to get faculty to take ownership continues (Lederman, 2010).

The MIS faculty got together and decided that since assessment had to be done, it needed to be done correctly. The faculty reviewed the mission and goals of the college. The college had goals relating to ethical principles, communication skills, global understanding, responsible citizenship, analytical skills, and core business knowledge. It was decided that the college core business classes covered all these goals and the MIS assessment plan should focus on what made MIS majors different from any other BBA graduate.

Over a few months, the MIS faculty came up with a list of what a MIS graduate should be able to do upon graduation. After much discussion, the list was whittled down to five items:

1. Determine requirements and design an information system
2. Design and create a well-designed, validated web site
3. Design, manipulate, use, and manage databases
4. Design, code, debug, and use business applications
5. Design, implement, and maintain information technology infrastructure

These program goals reflected the areas of MIS that were being emphasized within this program. In some cases, curriculum needed to be modified to reflect the agreed upon goals. Assessment and curriculum redesign go hand in hand. During this time, it was observed that the course objectives were not always aligned with the program mission and goals. Some revision of the courses to realign with industry standards and the standardized curriculum (IS 2002 Curriculum) was done.

There are eight required courses within the major. Electives and tracks had been eliminated over the lean years in order to assure classes will be full of students. Therefore, every student graduates having taken the same MIS courses.

Semantics can always be an issue when a group of faculty is attempting to decide on anything. Bloom's Taxonomy was used to assist in deciding which verbs should be used. (This will be discussed in detail later in the paper.)

We Know What Our Goals Are, Now What?

Course Mapping

The next step was to map the eight required courses to the program goals. The faculty had to know which program goals were being covered in which classes. This also led to curriculum discussions of exactly what was being taught in each class. Faculty learned a lot about the classes they did not teach.

The eight required courses are

Junior Year

CBIS 3212 – Introduction to Programming (Fall)

CBIS 3213 – Introduction to Networking (Fall)

CBIS 3214 – Database Management (Spring)

CBIS 3219 – Web Development (Spring)

Senior Year

CBIS 4210 – Advanced Programming (Fall)

CBIS 4212 – Business Analysis (Fall)

CBIS 4214 – Information Systems Deployment (Spring) *IS Capstone

CBIS 4225 – System Administration (Spring) *IT Capstone

It was decided that the eight required courses mapped to the five program objectives as follows:

1. CBIS 4210, CBIS 4212, CBIS 4214
2. CBIS 4212, CBIS 3219, CBIS 4214
3. CBIS 3214, CBIS 4210, CBIS 4214, CBIS 4225
4. CBIS 3212, CBIS 3214, CBIS 4210, CBIS 4214
5. CBIS 3213, CBIS 4225

The capstone courses appear multiple times because they are integrating what is learned in earlier courses. The faculty could have easily argued that most all courses fit every goal, but they tried to stick to the predominant objectives of a course. For example, Introduction to Programming (CBIS 3212) is not listed under program goal one – determine requirements and design an information system. It was decided that most requirements and designs are given to the students during this class, and it would be better to put the Advanced Programming course (CBIS 4210) as directly supporting this goal.

By producing the goals and the map of the courses directly supporting these goals, it can easily be explained to students why each course in the major is important and how each ties into what is expected for students to know when they graduate.

Course Objectives

The next step was to examine the course objectives for each course. The faculty members teaching a course got together to determine which objectives listed on the syllabi needed to be removed, which updated, and if any should be added. They made sure that objectives listed on the syllabus directly tied to the program goal(s) that the course was listed as supporting.

After faculty worked on objectives for their individual classes, all the MIS faculty got together to discuss the objectives listed for each course syllabus. Bloom's Taxonomy was used to select the appropriate level of learning for the course.

Bloom's Taxonomy

Bloom's Taxonomy lists knowledge and the development of intellectual skills in the cognitive domain (Bloom, 1956). The categories within this domain go from simplest to the most advanced. This means that the first level must be mastered before the second level can be mastered, etc. The six levels are knowledge, comprehension, application, analysis, synthesis, and evaluation. Each of these levels has keywords associated with it (Clark, 2010).

By using these keywords in the objectives for each course, assurance is achieved that learning may be measured at the correct level. The faculty used the keywords for the level of learning they desired in writing the course objectives. For example, the beginning programming course would not expect learning to fall in the latter two levels, while in the advanced course that follows, learning may fall into these last two categories. The faculty had discussions about what level of learning students could realistically achieve from each of the eight courses.

The Assessment Plan

Once goals and objectives were set a plan was put into place to assess them. The faculty elected to take one academic year and assess one objective for each of the four junior level courses. The teaching faculty member selected whether the assessment would be conducted for a project, exam question, etc. The plan has two outside faculty members (ones that are not teaching the course, but with some knowledge in that area) doing the assessment.

The plan reads: Two faculty members will use a rubric to evaluate the objective(s) measured by the assessment item. The first faculty member listed is “in charge”.

It is that person’s responsibility to:

Remind the instructing faculty member to get copies of the assessment.

Get the secondary faculty member to rate the assessment.

Write the results up by Jan. 15 or July 15.

Give the results to the faculty member writing the MIS assessment summary.

Report to the faculty on the results in the next MIS assessment meeting.

CBIS 3212 – A & B

CBIS 3213 – B & C

CBIS 3214 – D & E

CBIS 3219 – E & B (where A-E are different faculty members)

For example, in CBIS 3214 – Database Management, the teaching faculty elected to use an exam question to evaluate the SQL knowledge of the students. Faculty member D got copies of the exam question from the teacher. Both D & E used the rubric to rate the students’ answers. Faculty member D wrote up a brief summary of the results and presented it to the MIS faculty at the fall MIS assessment meeting. The faculty decided the students were not meeting the desired learning goal and strategies were put into place to improve these outcomes. The same goal, objective, and exam question will be used during the next academic year to assess this again to see if the results have improved.

The process of using two outside the class faculty members to do the actual assessment could certainly be considered overkill. It is completely acceptable to have the faculty member teaching the class as the only person reporting the assessment results. The faculty decided to go this route to add validity to what was being evaluated (two people rather than one), to allow all faculty members to have detailed knowledge of what the curriculum covered, and to encourage more conversation among the MIS faculty about the best ways to cover certain topics.

Assessment Results

The results from this assessment during fall semester 2009 led to a restructuring of what was covered in one course, and to two courses being swapped (i.e., junior level switched with a senior level course). We are currently in our second year of this assessment plan and have added an assessment of an objective in the senior level courses this year.

The idea is to cycle through all the objectives within a course during a five-seven year cycle. Since each goal is supported by more than one course, each goal will be assessed multiple times during this cycle.

A MIS assessment meeting is held every fall and spring. The results from the previous semester are discussed, modifications to the plan are made if needed, and reminders are given as to what will be assessed that semester.

This close the loop process allows faculty to understand if students are learning what is intended. If it is found that expectations are consistently being met (this hasn't been found in most cases so far), then expectations can be raised in the future.

Lessons Learned

Communication is key. There is an assessment coordinator for the MIS area. This person reminds everyone what assessments are supposed to be done that semester and requests results from the person in charge of each course. The MIS coordinator presents the MIS summary at the fall College of Business assessment meeting and gives this information to the college coordinator for inclusion into the annual college assessment report.

Documentation is essential. Minutes are written for every meeting. This brief summary documents what we reviewed and changed. This is essential in order to keep everyone straight on what they are doing for assessment as well as to provide historical information.

Leadership is important. Someone has to lead the charge and begin the process. If the structure does not exist within the college to support something along these lines, then a senior faculty member just has to do it. While the entire faculty must own the process and make the decisions, someone has to moderate and facilitate.

Cooperation without pressure is necessary. Faculty members must not feel the assessment is assessing their teaching. It has to measure how well the students learned and stay away from any accusations. Because all our faculty members are involved so deeply in the process, we all try to be very objective when discussing results. It would be easier for people not as involved to throw stones.

Conclusions

In summary, faculty participation made this assessment plan possible. Without faculty members from all areas of MIS, it would have been difficult to accomplish this. It took one academic year to get the goals, objectives, and put a plan in place. During the next academic year, the junior level courses were first assessed. Beginning the third year, one objective from each course will be assessed each year.

There are two main assessment meetings. One in the spring to discuss the fall results (instructors tend not to write summaries until it is time to discuss them), and one in early fall to discuss the spring results and what changes will be made to the assessment plan for the following year.

Communication, documentation, leadership, and cooperation are all important in order for the assessment to operate smoothly. Remember, assessment is not about achieving stellar results; it is about assuring students are learning the objectives needed to graduate with the knowledge and skills required to succeed.

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USING DIGITAL MEASURES TO OPTIMIZE ACCOMPLISHMENTS FOR EVALUATION AND ASSESSMENT REPORTING PURPOSES

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ABSTRACT

This paper will summarize how Digital Measures, a secure, web-based information management system, has been used by a School of Business to develop faculty yearly portfolios entirely on-line. So much time is wasted preparing hard copies of yearly evaluation portfolios for faculty. This paper will show how one university now has its faculty vitas, Summary of Professional Activity (SPA) forms, Faculty Annual Performance Rating Forms (FAPRF), Faculty Publication Matrix, Student Evaluation of Faculty percentile scores, and Student Comments in Digital Measures, and other documents needed for yearly portfolios entirely on-line. The paper will show how the on-line format has increased the effectiveness and efficiency of both the administration and faculty evaluation process.

INTRODUCTION

Clayton State University (CSU) is a technology focused, progressive university located in southern metropolitan Atlanta. Its School of Business currently has 32 faculty members, including a Dean, Associate Dean, two assistant deans, and an endowed chair position. The School of Business has a comprehensive quantitative faculty evaluation system, and each year the faculty are required to submit end-of-year portfolios.

The School has been AACSB accredited since 2005 and its five-year reaffirmation report will be due in February 2011. In 2004, The CSU School of Business adopted Sedona as its web-based management system. This system worked well, but, effective May 1, 2007, the entire university adopted Digital Measures, so the School of Business has now been using it. The School of Business currently has four e-ports in Digital Measures:

- Vita (specific to the School of Business)
- Summary of Professional Activity Form (SPA)
- Faculty Annual Performance Rating Form (FAPRF)
- Faculty Publication Matrix

Digital Measures currently has many uses. All reports become part of the official file of each faculty member. Digital Measures also assists in making decisions regarding faculty

evaluation and is used for faculty development purposes. Each of these forms listed above is completed entirely on-line, so there is no need for faculty to make hard copies of the forms. In addition, student evaluations of faculty percentages are also input by an administrative assistant into Digital Measures. In the past, faculty have printed hard copies of all documents and then included them in their end-of-year portfolios. Beginning in January, 2011, however, the Associate Dean will look at the evaluation documents of each faculty member on-line in Digital Measures. In addition to saving the Associate Dean the unnecessary energy of having to tote around 32 portfolios, it will also provide a huge saving, in both time and expense, to each faculty member.

THE BENEFITS OF USING DIGITAL MEASURES FOR PORTFOLIO PURPOSES

The benefits of using Digital Measures as the source of the yearly portfolio data are many. By having all of the required documents in Digital Measures, the faculty knows exactly what needs to be included. Having such clear expectations has substantially increased intellectual contributions by faculty, and has also given the faculty insights into strong and weak areas of individual performance.

In addition to the School of Business records, the use of Digital Measures has made it easier for the Associate Dean to compare the intellectual contributions by faculty, as stated on AACSB table 10 - 1: Summary of Faculty Qualifications, Development Activities, and Professional Responsibilities. This, in turn, has made it easier to recognize what professional development and other professional activities have been accomplished by faculty.

In the past, faculty members have submitted yearly portfolios (at least one notebook and sometimes two) of their accomplishments. The portfolios were due the third week of January, for the previous year, and faculty often spent their Christmas break completing the portfolios. In addition, there was a huge amount of paperwork, involving necessary cost. Further, the Associate Dean would have at least 32 portfolios notebooks of 3.5 inches each. By using Digital Measures to evaluate faculty accomplishments, the entire evaluation process can be done on-line.

HOW THE PROCESS WORKS

Each year the faculty member enters data into his/her Summary of Professional Activities (SPA) form (Figure 1 below; due to space constraints, only the first page is shown), which reviews in detail all of the relevant professional activities that the faculty member has accomplished during the year.

Summary of Professional Activity

Name _____ Faculty Rank and Effective Date _____
 Department/School: School of Business _____ Highest Degree **General Information/Education/Degree** _____
 Date Range: _____ Date of Hire and Tenure Status _____

I. TEACHING

A. Measures of Quality

Measures of Quality (2 points for each % point over 70% in the Almost Always (AA) and Frequently (F) categories. The number of points should be based upon a cumulative total of the class evaluations' percentages. Documentation for each class evaluated must be included in the portfolio.)				
Total Number of Students Enrolled in All Classes (after add-drop period), including summer, during the year	Total Number of Students Completing Evaluations During the Year	Total Number of Responses to all Questions	Total Number of Responses to Questions in the <i>Almost Always (AA)</i> and <i>Frequently(F)</i> categories	Average Percentage of Responses in the <i>Almost Always (AA)</i> and <i>Frequently(F)</i> Categories on all Questions (1- 20) for all Classes Evaluated

B. Instruction of Students

Course Number	Course Title	CRN #	Terms Taught	Credit Hours	Students Enrolled after add drop	Online OnCampus Hybrid	A	B	C	D
							# of Students Completing Evaluations	# of Responses in AA & F categories	# of Responses in all categories	% of Responses in AA & F categories
Totals										

Application of Technology in Instruction Teaching/Applications of Technology to Teaching			
Course title	Term(s)	# of Terms	Description of How Technology is Used in Instruction
Course title	Start Term – End Term	Number of Terms	Description

Direction of individual student research or internships Teaching/Directed student learning			
Course No.	Student Name	Term	Description of research project or internship
Course prefix and course number	Student first name & student last name	Term and year	Title of student work & comments

A faculty member must also make sure that the Faculty Annual Performance Rating Form (FAPRF) is completed in Digital Measures. Faculty are provided “mapping” to complete both the SPA and FAPRF (see Figure 2 below for an example of the FAPRF mapping.)

	POTENTIAL POINTS	ACTUAL POINTS	Digital Measures	DIGITAL MEASURES BUTTON > ACTIVITY
SERVICE (Effort Allocation = .15; maximum of 120 points, .15 x 800 = 120)				
<i>MINIMUM EXPECTED PERFORMANCE: (.70 x 120 = 84)</i>	84			
Faculty are expected to serve on at least one school committee, and Participate in an NSAT, New/Transfer Student Open House, or Informational Forum, and Accomplish at least one of the following: 1. Serve on at least one University Committee. 2. Serve as a mentor to full-time and/or part-time faculty. 3. Provide significant support to student organizations and/or campus activities. 4. Significantly contribute to the improvement of campus life. 5. Significantly contribute to the improvement of community life related to one's discipline. 6. Participate in community activities and organizations which enhance Clayton State's image in the community. 7. Provide other significant service to the institution. 8. Accomplish a Professional Service Assignment.				Service>MEP1 Service>MEP2 Service>MEP3 Service>MEP4a Service>MEP4 Service>MEP4 Service>MEP4 Service>MEP4 Service>MEP4 Service>MEP4 Service>MEP4 Service>MEP4
ADDITIONAL POINTS: If MEP is not reached, start at 60 points. 12 points for any of the following: Maximum points = 36**				
Officer in a professional organization				Service > Professional > Position/Role>type of officer
Reviewer/Discussant at a conference				Service > Professional>Position Role>Reviewer
Track Chair at a conference				Service > Professional>Position Role>Track Chair
Editorial Board member for a journal or Proceedings				Service > Professional>Position Role>choose type
Reviewer of articles or textbooks				Service > Professional> Position Role>type
Community Service				Service > Community Service>Position Role>choose type
Service to the School/University				Service > Academic Advising or Mentoring or Admin of Programs or Admin of Budgets or Other Service
Conference Proceedings Editor (professional as well as academic)				Service > Professional >Position Role> Editor,Conference Proceedings
Conference Coordinator (professional as well as academic)				Service > Professional> Position Role>Conference Coordinator
Public Services Work (prof. views quoted in newspapers, other recognition)				Service > Public >Position Role>Other
Advisor for appropriately chartered Student Club or Organization				Service > Support to Student Organization>Advisor
Strategic Initiative - Service (12 points max)				Service>Strategic Initiative
Other*				Home Award-Honor or Award (Category = Service)
Total for Service		0		
* Up to 23 points per year may be given for accomplishments in the Service area for activities that are recognized in AACSB Standards.				
** To get maximum points, faculty must have three activities, each with a weight of 12				

	POTENTIAL POINTS	ACTUAL POINTS	DIGITAL MEASURES	DIGITAL MEASURES BUTTON = ACTIVITY
SCHOLARLY ACTIVITY (Effort Allocation = .25; maximum of 200 points, .25 x 800 = 200)				
<i>MINIMUM EXPECTED PERFORMANCE: For Two Consecutive Calendar Years -- (.70 x 200 = 140)</i>				
1. One refereed journal article/scholarly book (accepted for publication or in print) every 2 calendar years;				
Citation of publication and acceptance date:				Scholarship/Res: MEP1
2. One other intellectual contribution (refereed* or non-refereed*) every year				Scholarship/Res: MEP 2
ADDITIONAL POINTS: If 70% is not reached, start at 160 points.				
Refereed Journal Article (in print, that is applied and/or instructional development in nature) ****				Scholarship/Intd Cont=20% or below; refereed = yes, MEP year
20 Percent or Below Acceptance (60 points per article)****				Scholarship/Intd Cont= 21 to 30%; Refereed = yes, MEP year
21 - 30 percent (80 points per article)****				Scholarship/Intd Cont= 31 - 40%; Refereed = yes, MEP year
31 - 40 percent (90 points per article)****				Scholarship/Intd Cont= 41 - 50%; Refereed = yes, MEP year
50 Percent or Above Acceptance (120 points per article)****				Scholarship/Intd Cont= 50% or above; refereed = yes, MEP year
Refereed Textbook/Scholarly Book (60 points per book)				Scholarship/Res=IC=contribution type = book, scholarly, new; Refereed = Yes, MEP year
Refereed Book Chapter/Cases (20 points per article)				Scholarship/Res=IC=contribution type = book chapter; Refereed = Yes, MEP year
Revision of Same (12 points)				Scholarship/Res=IC=contribution type = book chapter = revised; Refereed= yes; MEP year
Refereed and Published Software/Instructors Manual/Study Guide (15 points per activity)				Scholarship/Res=IC=contribution type = Instructor's Manual, etc; Refereed = yes; MEP year
Int'l or Nat'l. Refereed Conf. Paper : Presentation and Proceedings (15 points per paper)*****				Scholarship/Res=IC=Conference Proceedings, audience = Int'l or National, peer reviewed = yes
Regional refereed Conf. Paper: Presentation and Proceedings (10 points per paper)*****				Scholarship/Res=IC=Conference Proceedings, audience = local, state; peer reviewed = yes
Best Paper Award (for best paper recognition at a conference) (10 points per paper)				Scholarship-Presentation=Best paper award - conference
Best Paper Award (for best paper recognition in a track) (5 points per paper)				Scholarship-Presentation=Best paper award = Track
Refereed Published Book Review in a journal (10 points per review)				Scholarship=IC=contribution type = Book Review; Refereed = yes
Non-refereed Journal Article (8 points per paper)				Scholarship=IC=contribution type = Journal Article; Refereed = no
Non-refereed Professional Output, Presentation and/or Paper (e.g., providing training and CPE); * (4 points each) (A maximum of 12 points per year)	12			Scholarship=IC=contribution type = several choices; Refereed = no
Funded Grants (12 points per grant)				Scholarship=Grants; Grants=current status = funded
Scholarly-oriented contribution to strategic initiative (12 pts. Max)				Scholarship/Research=Strategic Initiatives
Other**				Honor/Award-Honor or Award (Category = Research)
Total for Scholarly Activity		0	0	
		Grand Total	0	

* Points awarded only once per presentation per year

** Up to 25 points per year may be given for accomplishments in the Scholarly Activity area for activities that are recognized in AACSB Standards

*** As the date of publication of refereed journal articles is at times hard to predict, points earned for published refereed journal articles, which are not counted in the year published, may be counted once during the next four subsequent years. Points cannot be carried over for any other categories

**** Points will only be awarded for articles having three or less authors

In addition to these two forms, the employee enters data, under the Intellectual Contributions section of Digital Measures, that permits them to complete the his/her Faculty Publication Matrix. This document is important because it is used by the Associate Dean, in addition to individual data obtained from Table 10 – 1 in Digital Measures, to determine faculty Academically Qualified (AQ) status.

CLAYTON STATE UNIVERSITY
School of Business
Faculty Qualification Status
Year: 2010

Michael Deis

Degree Information:
 Ed.D., Educational Leadership

Primary Teaching Areas:
 Management, Quantitative Analysis

Year Hired: 1997

Classification: Tenured

Code for Table Below:

P = year in which article was published
 C = year used for course load reduction
 M = year in which article is counted as part of the minimum expected performance.
 F = year used for FAPRF points
 Y = in field, N = not in field

Types of Publications:

- L & P: Learning and Pedagogy
- CP: Contributions to Practice
- DB: Discipline Based

Academic Qualification Data:

Year Published	Citation	Type of Publication	Acceptance Rate	In Field	2005	2006	2007	2008	2009
2009	Thompson, M. A., Deis, M. H., Peeter, R. (2009). Identifying measures of success for non-traditional students in learning communities. <i>Global Education Journal</i> , 2009(1), 10 - 22. Citation	L & P	50 percent or above	Y					P
2009	Sarner, S., Deis, M. H. (2009). How can interdisciplinary collaboration between schools promote culturally diverse students' success?. <i>Academy of Educational Leadership Journal</i> , 13(4), 19 - 34.	L & P	21 to 30 percent	Y					P
2008	Sandusky, J., Deis, M. H. (2008). How well does your tech support support higher ed? Do you and should you measure?. <i>Global Education Journal</i> , 3, 51 - 64.	L & P	50 percent or above	Y				P	

Qualifications Summary:

As of January 2010, the Faculty Qualification Status of Dr. Michael Deis is Academically Qualified (AQ), based on the standard of achieving at least quality publications over the preceding five year period.

It is expected that Dr. Deis will continue to meet the standards for AQ in 2010.

 Associate Dean

Evaluation percentage for teaching evaluations and student comments on the teaching evaluations are also entered into Digital Measures by administrative staff in the School of Business. Finally, the faculty member downloads a “Yearly Portfolio Summary” memo, by year, in Digital Measures. Based on the information given in the faculty member’s vita (which is also in Digital Measures), the SPA, FAPRF, the Faculty Publication Matrix, the Associate Dean then looks at the “Yearly Portfolio Summary” memo, which is a maximum of five pages, in Digital Measures and completes a yearly evaluation of that faculty member.

This process has made the evaluation process very clear, effective, and efficient. All forms become part of the faculty member’s electronic portfolio. Once the final portfolio summary is submitted, it becomes part of the faculty member's official file.

LESSONS LEARNED

The faculty acceptance of going electronic (i.e., going green) with the entire portfolio process has been excellent. Faculty members appreciate not having to develop hard massive portfolio notebooks each year, and they also appreciate the convenience of continually being able to update their portfolios in Digital Measures. Both the faculty and the administration appreciate having the web-based reporting system. Since the faculty FAPRF is primarily an objective system, the Associate Dean, at least in the first year of this program, has been able to easily review the faculty accomplishments for yearly portfolio, evaluation, and merit purposes.

TRANSPORTATION PROBLEM WITH QUADRATIC COST COEFFICIENTS

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ABSTRACT

We present a novel analytical algorithm to solve transportation problems with quadratic function cost coefficients. The algorithm uses the concept of absolute points developed by the authors in earlier works. The versatility of the proposed algorithm is evident by the fact that quadratic functions are often used as approximations to other functions for example applying the well-known regression analysis. To the best of our knowledge this is the first attempt to address quadratic function costs coefficients in a transportation problem. We present a numerical example to illustrate application of the proposed method.

INTRODUCTION

The classical transportation problem (TP) is a well-structured problem that has been studied extensively in the literature. The TP deals with the distribution of goods from several points of supply (sources) to a number of demands (destinations). Usually we have a given capacity of goods at each source and a given requirement for the goods at each destination. The objective is to schedule shipments from sources to destinations so that total transportation cost, $\sum \sum c_{ij}x_{ij}$, is minimized.

Generally only linear transportation costs have been considered such that a TP can be formulated as a linear program and solved by the regular simplex (big-M), the dual simplex method or even an interior approach. A limited number of researchers have considered variations in TP cost functions. Szwarc [1] develops a method for solving TPs with cost coefficients of the form $c_{ij} = u_i + v_j$, having applications in shop loading and aggregate scheduling. Along the same lines, with applications to stock location and information storage, Evans [2] considers TPs in which cost coefficients are factorable, that is, $c_{ij} = u_iv_j$. Other researchers have studied the fixed-charge transportation problem (FCTP) in which a fixed cost, sometimes called a setup cost, is incurred if when a route is activated [3]. Hirsch and Dantzig [4] establish that the feasible region of an FCTP is a bounded convex set.

Quadratic functions are versatile, as they can be used as approximations for many other functions, as with regression analyses and have been used to model special scheduling problems. In this paper we propose a novel direct analytical method to solve a quadratic transportation problem (QTP) where the cost coefficients are quadratic functions. The proposed algorithm exploits the properties of absolute points developed by the authors in earlier works [8] to solve a TP with linear costs. It is easy to apply and provides insight into the problem and, with this, the ability to critically analyze the problem. The algorithm can also be used as a pre-processor to reduce the problem size.

THE QUADRATIC TRANSPORTATION PROBLEM

Similar to the classical transportation problem, the quadratic transportation problem (QTP) can be stated as a distribution problem in which there are m sources and n destinations. Each source $i = 1, 2, \dots, m$ has supply of a_i units and each destination $j = 1, 2, \dots, n$ has a demand of b_j units. Each of the m sources can supply to any of the n destinations at cost $f_{ij}(x_{ij})$, where $f_{ij}(x_{ij})$ is a quadratic function of x_{ij} , the amount shipped from source i to destination j . The objective is to minimize the total transportation cost while meeting demand at the destinations.

Mathematically, a balanced QTP is formulated as:

Problem QTP:

$$\text{Minimize } Z = \sum_{i=1}^m \sum_{j=1}^n f_{ij}(x_{ij}) \quad (1)$$

$$\text{Subject to } \sum_{j=1}^n x_{ij} = a_i \quad \text{for } i = 1, 2, \dots, m, \quad (2)$$

$$\sum_{i=1}^m x_{ij} = b_j \quad \text{for } j = 1, 2, \dots, n, \quad (3)$$

$$\sum_{j=1}^n a_i = \sum_{i=1}^m b_j \quad (4)$$

$$f_{ij}(x_{ij}), x_{ij}, a_i, b_j \geq 0 \quad \text{and} \quad f_{ij}(0) = 0 \quad (5)$$

One constraint out of Equations (2) and (3) is redundant if the QTP is balanced, i.e., if Equation (4) is satisfied. Note that similar to a regular TP and FCTP we assume non-negative conditions and zero value of cost functions at 0, as shown at (5).

As mentioned earlier, there is no direct efficient algorithm available to solve Problem QTP. Of course, one can perhaps attempt to solve Problem QTP as a quadratic program with a quadratic objective function involving $m \cdot n$ variables subject to $(m + n)$ linear conditions. The problem thus formulated can perhaps be solved using the theory of Lagrange multipliers. The process is very cumbersome involving taking partial derivatives with respect to each of the variables including $(m + n)$ Lagrange multipliers and solving the resulting $(m \cdot n + m + n)$ equations. This task could be overwhelming even for a small size QTP. In addition in case of a higher than second degree polynomial function, one cannot be sure if the point obtained is a local minima or the global minimum.

Before we proceed, we reiterate some terminology from the TP literature. A location (i, j) is said to be loaded (or occupied) if there is a value assigned to it in the solution. Location (i, j) is said to be *fully loaded* if that value equals $\min(a_i, b_j)$, i.e., the assignment exhausts supply a_i at source i and/or demand b_j at destination j . Location (i, j) is interchangeably referred as cell (i, j) .

Absolute Points for the QTP

Definition 1: An absolute point (AP) is a cell (q, r) in a QTP that must be occupied in any optimal solution within the interval from 0 to the smaller of the values a_i and b_j .

The procedure for finding an AP is based on the following assumptions:

- (i) There is a cell (q, r) in a QTP that must be occupied in any optimal solution within the interval from 0 to the smaller of the values a_i and b_j —i.e., an AP exists.
- (ii) If such a cell (q, r) were excluded in a given distribution, i.e., not loaded, then there exists an SS chain leading to cell (q, r) from every other cell that is occupied.

Suppose cell (q, r) is an AP. Then this cell (q, r) must be loaded with a shipment from supply a_q and demand b_r to eliminate the cell (q, r) from future computations. Not loading it means that, for every other loading in row q and column r , there will be an SS chain leading to cell (q, r) . So we have to prove the existence of an SS chain leading to (q, r) from every other cell in row q and column r . If we ignore cell (q, r) , we have to load other cells in row q and column r , for example cells (k, r) and (q, p) , to satisfy demand and supply requirements.

	Column r	Column p
Row k	$f_{kr}(x)$	$f_{kp}(x)$
Row q	$f_{qr}(x)^*$	$f_{qp}(x)$

If there is an SS chain leading to a cell (q, r) , then, to guarantee a gain from this transaction, we must have

$$\text{or} \quad \begin{aligned} & f_{kr}(x) - f_{qr}(x) > f_{kp}(x) - f_{qp}(x) \\ & \{f_{kr}(x) - f_{qr}(x)\} - \{f_{kp}(x) - f_{qp}(x)\} > 0. \end{aligned} \quad (9)$$

For a given q and r , if inequality (9) holds for every $k = 1, 2, \dots, m$, and every $p = 1, 2, \dots, n$, then (q, r) is an AP location, and the value $\{f_{kr}(x) - f_{qr}(x)\}$ is the largest of the comparisons between rows k and q . Note that the left-hand side of (9) represents the penalty for placing assignments at locations (k, r) and (q, p) rather than at location (q, r) . What follows are the steps for identifying an AP in a QTP with cost functions $f_{ij}(x)$. See Adlakha and Kowalski [5] for details. These steps involve pivoting on the q th row in the first QTP cost matrix.

Step AP1: Calculate $f_{ij}^q(x) = f_{qj}(x) - f_{ij}(x)$, $i = 1, 2, \dots, m, j = 1, 2, \dots, n$. Ignore the q th row.

Step AP2: Draw all n quadratic curves $f_{ij}^q(x)$ on the same graph, $i = 1, 2, \dots, m, i \neq q$.

Step AP3: Determine the minimum function $f_i^q(x)$ within the range for each $i, i \neq q$.

Step AP4: An AP exists if the minimum functions in each row are in the same column.

Remark 1: For Step AP2, many software packages are easily available to draw the quadratic curves and to study the ranges.

Remark 2: For Step AP3, to determine the minimum element $f_i^q(x)$, one should simply limit the search to the range of 0 to $\min(a_q, b_j)$ for $j = 1, 2, \dots, n$. There is no need to exceed the range $\min(a_q, b_j)$ as this is the maximum load that can be assigned at cell (q, j) .

Absolute Quadratic Algorithm for the QTP

The algorithm identifies the AP cells, which are loaded sequentially, and the QTP is reduced. From the absolute point theory it is obvious that if a cell were an AP, loading it would not have an impact on the distribution of the remaining loads. Also note that once an AP is identified, it is clear that has to be loaded with the maximum possible amount, in view of equation (6).

Step 1: Look for AP cells along each row.

Step 2: If none: go to Step 6. Otherwise continue.

Step 3: For each AP cell (q, r) , assign $x_{qr} = \min(a_q, b_r)$. Change $a_q \rightarrow (a_q - x_{qr})$, $b_r \rightarrow (b_r - x_{qr})$.

Step 4: If modified a_i or $b_j = 0$: delete the corresponding i th row or j th column.

Step 5: If the above analysis yields a solution, STOP. Else go back to Step 1 with the reduced cost matrix.

Step 6: Else find a solution to the reduced cost matrix using any inductive method.

Remark 3: Often assignments in a row or column may be completed after a few initial assignments and using other row and column constraints logically afterwards.

A NUMERICAL EXAMPLE

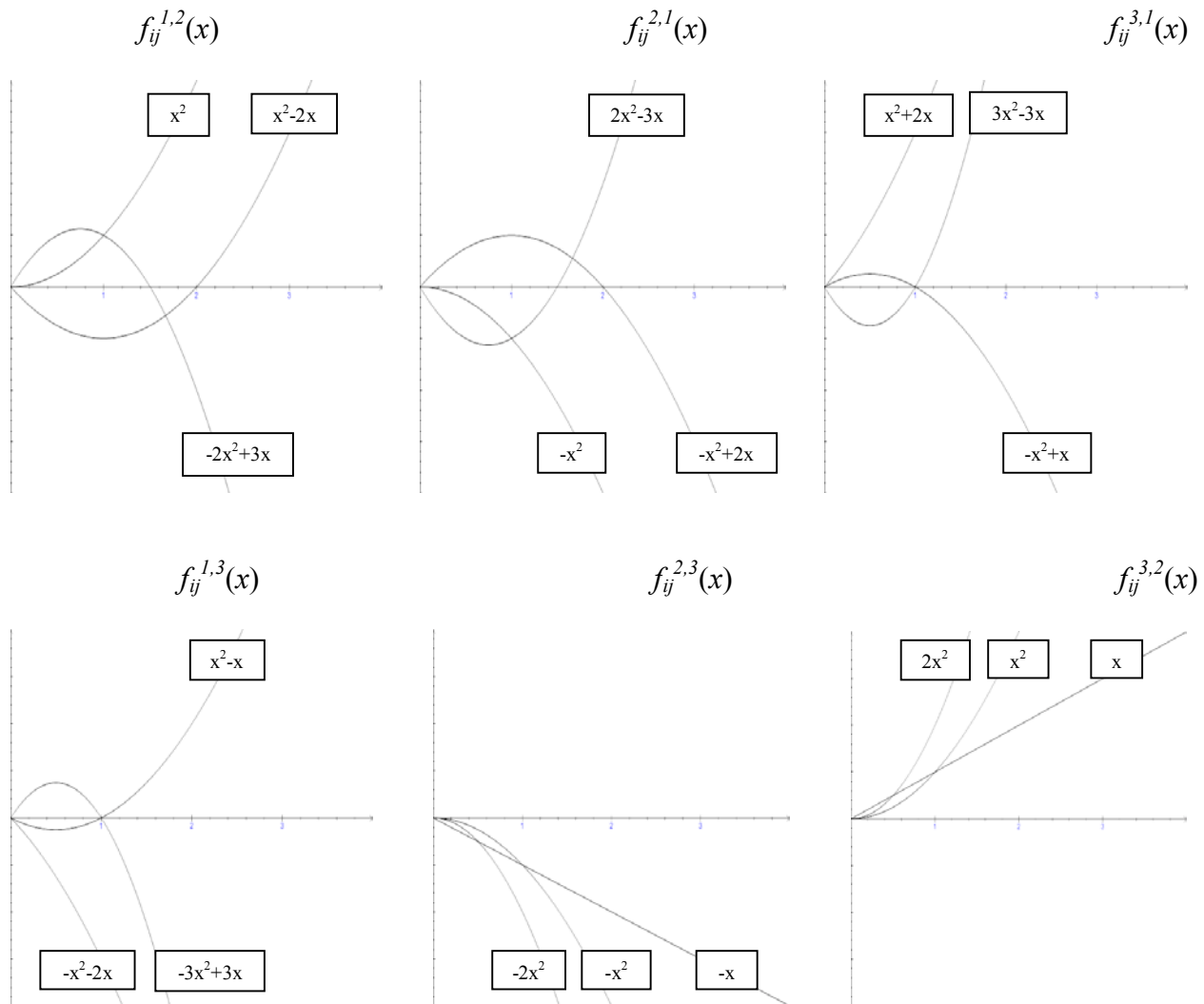
We explain the Absolute Point Algorithm for QTP with the following example of a quadratic transportation problem.

Table 1. Cost Matrix $f_{ij}(x)$ for the QTP Example

	b_1	b_2	b_3	Supply
a_1	$2x^2+x$	$3x^2+2x$	x^2+4x	2
a_2	x^2+3x	$2x^2+2x$	$3x^2+x$	2
a_3	$3x^2+3x$	$2x^2+3x$	$4x^2+x$	2
Demand	1	4	1	

Step 1: First we search for available APs in the cost matrix. *Step AP1* provides the following three $f_{ij}^q(x)$ matrices by pivoting on rows 1, 2, and 3. The corresponding curves for *Step AP2* are provided directly under each $f_{ij}^q(x)$ matrix. Since there are only three rows, each $f_{ij}^q(x)$ matrix have only two sets of differences $f_{qj}(x) - f_{ij}(x)$. The graphs related to pivoting on row 1 are provided directly beneath the $f_{ij}^1(x)$ matrix and so on. Therefore, the first set of three graphs presents the first set of three quadratic equations from $f_{ij}^1(x), f_{ij}^2(x), f_{ij}^3(x)$, respectively and the second set of three graphs presents the second set of the three quadratic equations from these matrices.

$f_{ij}^1(x)$			$f_{ij}^2(x)$			$f_{ij}^3(x)$		
b_1	b_2	b_3	b_1	b_2	b_3	b_1	b_2	b_3
-	-	-	$-x^2+2x$	$-x^2$	$2x^2-3x$	x^2+2x	$-x^2+x$	$3x^2-3x$
x^2-2x	x^2	$-2x^2+3x$	-	-	-	$2x^2$	x	x^2
$-x^2-2x$	x^2-x	$-3x^2+3x$	$-2x^2$	$-x$	$-x^2$	-	-	-



(i) *Step AP3:* Looking at the two curves under $f_{ij}^1(x)$, it is clear that the smallest function in $f_{ij}^{1,2}(x)$ is $f_{21}^1(x) = x^2-2x$ for $0 \leq x \leq 1$; and the smallest function in $f_{ij}^{1,3}(x)$ is $f_{31}^1(x) = -x^2-2x$ for $0 \leq x \leq 1$ where $\min(a_1, b_1) = 1$. *Step AP4:* Since minimum functions $f_{21}^1(x)$ and $f_{31}^1(x)$ are in, the first column, *Step AP5* indicates that cell (1, 1) is an AP.

(ii) Similarly looking at the two curves under $f_{ij}^3(x)$, it is clear that the smallest function in $f_{ij}^{3,1}(x)$ is $f_{13}^3(x) = 3x^2-3x$ for $0 \leq x \leq 1$; and the smallest function in $f_{ij}^{3,2}(x)$ is $f_{23}^3(x) = x^2$ for $0 \leq x \leq 1$ where $\min(a_3, b_3) = 1$. Since minimum functions $f_{13}^3(x)$ and $f_{23}^3(x)$ are in the third column, cell (3, 3) is an AP.

Step 3: (i) For AP cell (1, 1), assign $x_{11} = \min(a_1, b_1) = 1$. Change $a_1 \rightarrow (a_1 - 1) = 1$; $b_1 \rightarrow (b_1-1) = 0$. (ii) For AP cell (3, 3), assign $x_{33} = \min(a_3, b_3) = 1$. Change $a_3 \rightarrow (a_3 - 1) = 1$; $b_3 \rightarrow (b_3-1) = 0$.

Step 4: Since modified $b_1 = 0$ and $b_3 = 0$, delete the corresponding 1st and 3rd columns.

Step 6: The remaining supplies are easily assigned to the only remaining 2nd column to meet the demand $b_2 = 4$ units. The resulting solution follows with a total cost of 30 for shipping 6 units.

Table 2. Optimal Solution for 3x3 QTP

	b ₁	b ₂	b ₃	Supply
a ₁	1	1		2
a ₂		2		2
a ₃		1	1	2
Demand	1	4	1	

Note that the conditions for AP for the analyzed formulation are dynamic and depend both on the values of the function cost coefficients and on the demand and supply values. It means for example that a given AP location can stop being an AP for a different set of the demand and supply values.

CONCLUSIONS

We have developed a simple solution algorithm for solving a QTP. The Absolute Quadratic Algorithm is based on various intrinsic characteristics of a QTP. It looks for cells/routes that will always be used in an optimal solution due to cost efficiency regardless of supply and demand constraints. Since an absolute point must always be loaded in any optimal solution, loading it exhausts either a supply or demand. Upon depleting the corresponding row or column, the proposed method also reduces the dimensions of the cost matrix for QTP. After reductions and eliminations, the solution of QTP is “squeezed” into the remaining cells and may be determined logically in the last step. We extend the shadow price theory of classical transportation problem to the QTP and develop shadow function matrix to verify optimality. To the best of our knowledge, it is one of the first ever research effort presented for solving a QTP, which opens the door to new algorithms. Future work should seek extending the theory to coefficients represented with higher degree polynomials. Such functions can have local minima and therefore a gradient type algorithm can fail to obtain the global minimum. Note that it is possible that a QTP may not have any APs. In such a case other methods or estimations, including heuristics, can be used and the shadow price analysis can be used to confirm optimality. Future research is needed to develop other generally applicable methods.

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ON THE CHOICE OF TECHNOLOGY AND INDUSTRIAL POLLUTION

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ABSTRACT

In the paper [1], the author modeled the use of technology to control industrial pollution. The model only controlled pollution generated for external demand. The model is modified in this paper to ensure that pollution generated to satisfy both internal and external demands is controlled by choosing the appropriate set of technologies.

INTRODUCTION

Pollutants are produced each time an item is produced. The amount of pollutants produced depends not only on the type of raw materials, but also on the technology used [1], [3]. The amount of pollutants produced using a given technology is estimated. From this information, the amount of pollutants per unit output is calculated. Due to damages cause by pollution to life and the environment, pollution emission restriction is of global concern, as evidenced in global protocols and treaties [5], [6], [7].

In his book [4], Wassily Leontief (1986), who won the 1973 Noble Price in Economic Science for his model of input-output economics, gave an extended input-output system with pollution related activities included. The Leontief's model can be used to choose different technologies for the economy by solving many systems of linear equations, Leontief (1985). The problem studied in Ebiefung and Kostreva (1993) is an extension of the Leontief pollution model. This paper provides a new mathematical model, which is different from the Leontief's model and its various extensions, which shows that technology choice is a major factor in reducing industrial pollution.

The structure of the rest of the paper is as follows. In Section 2, the choice of technology model is presented. In Section 3, an extension of the model is provided. An algorithm for solving the modified model is given in Section 4. In Section 5, we summarize our results.

THE CHOICE OF TECHNOLOGY MODEL

The following is the problem addressed: Given different technologies for the production of an item by sector j , $j = 1, \dots, n$, which technology should be chosen by sector j so as to (1) satisfy permissible pollutant level for the sector j , and (2) satisfy exactly the demands for sector j 's output. Permissible pollutant level (PPL) is a pollutant quantity which places limits on the amount of pollutants a sector can produce.

Assumptions:

1. We consider one period of activities.
2. We assume that prices are fixed and that demand quantities are stable.
3. Pollutant quantities are adjusted to be the same as the permissible pollutant level.

Notation

Constants:

- n = number of sectors in the economy.
 m_j = number of different technologies available for the production of an output by sector j . Assume $m_j \geq 1, j = 1, \dots, n$.
 b^j = maximum amount of pollutants that sector j should produce in order to satisfy external demand for its services.
 a_{ik}^j = units of output of pollutants by sector j using technology i needed by sector k to produce one unit of its pollutants.

Variable:

- x_j = maximum amount of pollutants produced by sector j .

Matrices and Vectors:

$$A^j = (a_{ik}^j), \quad i = 1, \dots, m_j, \quad k = 1, \dots, n, \quad j = 1, \dots, n.$$

E^j = an $m_j \times n$ matrix with 1s in column j and zeros in all other columns.

$$A = \begin{bmatrix} A^1 \\ \bullet \\ \bullet \\ \bullet \\ A^n \end{bmatrix}, \quad E = \begin{bmatrix} E^1 \\ \bullet \\ \bullet \\ \bullet \\ E^n \end{bmatrix}, \quad Q^j = \begin{bmatrix} b^j \\ \bullet \\ \bullet \\ \bullet \\ b^j \end{bmatrix}, \quad X = \begin{bmatrix} x_1 \\ \bullet \\ \bullet \\ \bullet \\ x_n \end{bmatrix},$$

If we set $m = \sum_{j=1}^n m_j$, then A^j is $m_j \times n$, A is $m \times n$, $m \geq n$, Q^j is $m_j \times 1$, and X is $n \times 1$.

THE MODEL

The condition that the total amount of pollutants generated by sector j using technology i is equal to the amount required to satisfy external demand is equivalent to Equation (1).

Technology Choice Model (TCM):

$$\begin{aligned} (E^j - A^j)_i X &= Q_i^j, \quad j = 1, \dots, n, \\ X &\geq 0 \end{aligned} \tag{1}$$

where $i \in (1, \dots, m_j)$ and $A_i =$ row i of matrix A . We note that $(E^j - A^j)_i X \geq 0$.

THE EXTENDED MODEL

The model is extended in this section. The assumptions of the first model apply. The extended model makes it possible to restrict pollutants produced for inter-sector demands.

Let p^j be the amount of pollutants that sector j should produce in order to satisfy internal demand for its services as well as meet emission restrictions.

Let P^j be a vector defined by

$$P^j = \begin{bmatrix} p^j \\ \cdot \\ \cdot \\ \cdot \\ p^j \end{bmatrix}$$

where $j = 1, \dots, n$.

The condition that the pollutants generated by sector j using technology i is equal to the amount produced for both internal and external demands is given by:

Extended Technology Choice Model (ETCM):

$$(E^j - A^j)_i X = Q_i^j, \quad j = 1, \dots, n, \quad (2)$$

$$A_i^j X = P_i^j \quad (3)$$

$$X \geq 0$$

where $i \in (1, \dots, m_j)$ and A_i = row i of matrix A .

SOLVING THE ETCM

Solving the ETCM is considered in this section. By our notation, sector j has m_j technologies to choose from for producing an item. Therefore, the total number of different combination of technologies available for the economy is $T = \prod_{j=1}^n m_j$.

Using System of Linear Equations

The problem can be solved by using $T = \prod_{j=1}^n m_j$ system of linear equations. However, the strict equalities and the condition that $X \geq 0$ make it difficult to solve the linear systems efficiently.

Using a Linear Program

Solving the model by a linear program is preferable, since that will take care of the non-negativity condition on the variables. Moreover, the use of linear programs allows for sensitivity analysis, a handy tool when there are changes in the pollution input – output coefficients or in the required pollutant levels.

Let S be a technology state of the economy. Then $S = S(i_1, \dots, i_n)$ specifies the technology composition of the economy; where i_j means that sector j uses technology i in the production of its outputs. For each j , define

$\alpha_i^j =$ amount by which technology i of sector j under estimates the total amount of pollutants that should be produced by sector j in order to satisfy external demand.

$\beta_i^j =$ amount by which technology i of sector j over estimates the total amount of pollutants that should be produced by sector j in order to satisfy external demand.

$\delta_i^j =$ amount by which technology i of sector j under estimates the total amount of pollutants that should be produced by sector j in order to satisfy internal demand.

$\lambda_i^j =$ amount by which technology i of sector j over estimates the total amount of pollutants that should be produced by sector j in order to satisfy internal demand.

Define the following vectors:

$$\alpha^j = (\alpha_i^j), \quad i = 1, \dots, m_j,$$

$$\beta^j = (\beta_i^j), \quad i = 1, \dots, m_j,$$

$$\delta^j = (\delta_i^j), \quad i = 1, \dots, m_j,$$

$$\lambda^j = (\lambda_i^j), \quad i = 1, \dots, m_j,$$

where $j = 1, \dots, n$.

Algorithm

1. For each technology state $S = S(i_1, \dots, i_n)$, solve the linear program $LP_1(S)$:

$$\begin{aligned} \text{Min } z &= \sum (\alpha_{i_j}^j + \beta_{i_j}^j + \delta_{i_j}^j + \lambda_{i_j}^j) \\ \text{St. } (E_{i_j}^j - A_{i_j}^j)X + (\alpha_{i_j}^j - \beta_{i_j}^j) &= Q_{i_j}^j \end{aligned} \quad (4)$$

$$A_{i_j}^j X + (\delta_{i_j}^j - \lambda_{i_j}^j) = P_{i_j}^j \quad (5)$$

$$X \geq 0, \alpha_{i_j}^j \geq 0, \beta_{i_j}^j \geq 0, \delta_{i_j}^j \geq 0, \lambda_{i_j}^j \geq 0.$$

where $i_j \in S(i_1, \dots, i_n)$, $i = 1, \dots, m_j$, $j = 1, \dots, n$.

2. If the LP₁(S) has a solution for any j , $j \in (1, \dots, n)$, with $z = 0$, then the solution solves the ETCM.

The following theorem shows that Algorithm 1 solves the ETCM, if the ETCM has a solution.

Theorem

If the LP₁ (\bar{S}) has an optimal solution with objective function value $z(\bar{S}) = 0$, then the technology state $\bar{S}(i_1, \dots, i_n)$ satisfies the pollutants' emission requirement for the economy.

Proof: Suppose that there is a technology state $\bar{S}(i_1, \dots, i_n)$ such that the LP₁ (\bar{S}) has an optimal objective function value $z(\bar{S}) = 0$. Then we have that $\sum (\alpha_{i_j}^j + \beta_{i_j}^j + \delta_{i_j}^j + \lambda_{i_j}^j) = 0$. Since $\alpha_{i_j}^j \geq 0$, $\beta_{i_j}^j \geq 0$, $\delta_{i_j}^j \geq 0$, $\lambda_{i_j}^j \geq 0$, we have that for each j , $\alpha_{i_j}^j + \beta_{i_j}^j + \delta_{i_j}^j + \lambda_{i_j}^j \geq 0$. Thus $z(\bar{S}) = 0$ implies $\alpha_{i_j}^j = 0$, $\beta_{i_j}^j = 0$, $\delta_{i_j}^j = 0$, $\lambda_{i_j}^j = 0$. That is, there is no over or under production of pollutants when $\bar{S}(i_1, \dots, i_n)$ is applied to the economy. So $\bar{S}(i_1, \dots, i_n)$ satisfies the pollution emission requirement of the economy. This completes the proof.

For each j , the pollutant quantity generated by the chosen technology gives exactly the amount that sector j should produce.

CONCLUSION

We present a mathematical model for controlling the generation of industrial pollution by choosing the right set of technologies. The method is based on input-output pollution coefficients.

The appropriate set of technologies for reducing pollution emission is obtained by solving the model using a linear program. This makes it possible to perform sensitivity analysis when problem parameters need to be changed.

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Sensitivity Analysis of a MonteCarlo Risk Assessment Model for Voting System Threats

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Abstract—As voting systems increasingly rely on electronic means for casting, recording, and tallying votes, analysts need reliable models, tools, and techniques for assessing the riskiness of these systems. A risk assessment model and tool for voting systems called the Threat Instance Risk Analyzer (TIRA) is briefly described. The purpose of TIRA is to provide a rational and parsimonious quantification of an analyst's intuition or estimation of risk. However, it is important that analysts have confidence that such tools produce reliable results. The purpose of this paper is to describe the challenges, techniques and results of a sensitivity analysis of TIRA. The risk estimate values produced by TIRA were found to be insensitive to small changes in input values and therefore reliable.

Keywords—*risk assessment, Monte Carlo, sensitivity analysis, voting system*

I. INTRODUCTION

Assessing the riskiness of voting systems poses a difficult challenge for the analyst because of the complex mix of people, processes, hardware, software, policies, and legislation that goes into the relatively simple act of casting a vote and the fact that the ballot must be kept secret and the link between the casting of a vote and the counting of that vote must be ir retrievable [1]. Add to that the disparate technologies used in voting systems and it is little wonder that voting system security has heretofore been inadequate [2].

The Threat Instance Risk Analyzer or TIRA is a tool developed to deal with the complexity of voting systems risk assessment through the use of threat trees [3] and perturbation analysis [4]. Threat trees enable the analyst to model a threat from the perspective of an attacker by formally defining the set of steps necessary to execute a threat in a given context or scenario. Perturbation analysis allows the analyst to assign a quantitative value to their qualitative understanding of the riskiness of a threat. This

quantification is an estimate of the analyst's intuition about the risk of a given threat. The term estimate is important because TIRA was not designed to produce accurate point values but rather to document an analyst's understanding of risk such that it can be rationally defended and compared with the understanding of other analysts

A. Threats

TIRA assesses risk in terms of threats. A threat is defined as "the potential for a particular threat-source to successfully exercise a particular vulnerability" [5]. Vulnerability is a "flaw or weakness in system security procedures, design, implementation, or internal controls that could be exploited to accomplish a security breach or a violation of the system's security policy" [5]. TIRA models a threat as threat-source/vulnerability pairs, for example, "malicious outsider/weak passwords." A threat involves multiple threat-source/vulnerability pairs. Because these pairs can be combined in multiple ways to exercise a vulnerability, a challenge to the analyst is how to model this inherent complexity. One technique is threat trees.

B. Threat trees

Threat trees model threat-source/vulnerability pairs hierarchically as a collection of steps required to exercise a vulnerability. In TIRA, the root of the tree is the name of the threat itself and represents the goal of the threat. See Figure 1 for a screen shot of a threat tree in TIRA. Subordinate nodes in the tree or steps are modeled as AND, OR, or TERMINAL nodes. An AND node (node type A) indicates that all subordinate nodes must be achieved in order to achieve the higher level goal. OR nodes (node type O) specify alternate steps for accomplishing the higher level

goal. TERMINAL nodes (node type T) are steps or actions that are not decomposed further.

threat instance	threat id	node type	outline number	threat action
		O	1	attack voting equipment
	11	A	1.1	gather knowledge
	12	T	1.1.1	from insider
	1183	A	1.1.2	from components
	1014	O	1.1.2.1	access directly
	13	T	1.1.2.1.1	infiltrate as insider
	14	T	1.1.2.1.2	obtain a machine
1	162	T	1.1.2.1.3	legally acquire machine
	1184	T	1.1.2.2	directly examine
	1015	O	1.2	gain insider access
1	1016	T	1.2.1	at voting system vendor
	1017	T	1.2.2	in supply chain
	1018	T	1.2.3	in elections org
	1019	T	1.2.4	by illegal insider entry
	1020	T	1.2.5	by remote network access
	1185	O	1.3	attack component
	1021	O	1.3.1	attack hardware
	1023	T	1.3.1.1	jam PCOS scanner
	1024	O	1.3.1.2	attack stored components
	1025	T	1.3.1.2.1	swap boot media
1	1026	T	1.3.1.2.2	attack install
	1027	T	1.3.1.2.3	destroy RemovableMed
	1028	A	1.3.2	attack software
	1029	T	1.3.2.1	develop malware
	1030	O	1.3.2.2	inject malware
	1031	T	1.3.2.2.1	by remote bug exploitat

Figure 1. Threat tree in TIRA

In TIRA, the collection of steps sufficient to exercise a vulnerability is called a threat instance. For example, in Fig. 1, in order to attack the voting equipment, the attacker must gather knowledge (1.1), gain access to the equipment (1.2), and attack some component of the system (1.3). These three steps comprise the root node of “attack voting equipment”. In the threat instance of Fig 1, the attacker is legally acquiring a machine to investigate (1.1.2.1.3), gaining access to the equipment through a vendor (1.2.1), and attacks the install component of the equipment (1.3.1.2.2).

The threat instance is the unit of analysis in TIRA. By defining a specific scenario, risk estimates can be compared across analysts. Further, this deals with the state space explosion problem inherent in threat trees. For the threat tree depicted in Fig 1, there are hundreds of possible combinations of nodes sufficient to exercise the threat.

C. Remainder of paper

The remainder of this paper is organized as follows. The next section presents an overview of the risk assessment model proposed in this work. Following that is a section that explains the use of Monte Carlo simulation to implement perturbation analysis for risk estimation. The next section contains the algorithm for the Monte Carlo simulation. The final section provides concluding remarks.

II. TIRA RISK ASSESSMENT MODEL

Risk is defined as “the net negative impact of the exercise of a vulnerability, considering both the probability and the impact of occurrence” [5]. TIRA calculates risk as the product of probability and impact.

Where $P(T)$ is the probability of the occurrence of threat T :

$$\text{Risk} = P(T)(\text{Impact}) \quad (1)$$

TIRA calculates risk as a unit-less value, that is, the actual risk estimate value is arbitrary. The key characteristic of the risk estimate is the relative magnitude of the risk value. The output of TIRA is a rank-ordered list of threats from most risky to least risky. Rank ordering allows the analyst to evaluate trade-offs, perform sensitivity analysis, and estimate residual risk. We define residual risk is the risk that remains (or would remain) after a given control (counter measure) has been implemented.

$P(T)$ is a measure of the analyst’s estimate of how likely it is that a threat will be exercised by an attacker. $P(T)$ is intended not to be an accurate point estimate but rather a *ballpark figure* intended to establish a relative magnitude of risk. $P(T)$ ranges from 0 to 1 where 0 means impossible and 1 means inevitable. Analysts are prompted to express their confidence in their estimate by providing a lower and upper limit on their estimate. The $P(T)$ prompt in TIRA is reproduced below.

“Arbitrarily consider one hundred (100) federal elections. Assume a specific voting system configuration, threat countermeasures, controls, and protocols. First, of these 100 elections, in how many elections do you think this attack will be exercised? Second, express how confident you are in your estimate by indicating the maximum and minimum number of elections in which you think this attack will be exercised. Interpret this range of numbers as ‘I think the number will be [most likely], but it could be as high as [maximum] and as low as [minimum].’”

However, an assumption of TIRA is that likelihood is conditioned by factors associated with a specific threat scenario. That is, likelihood is increased or decreased based on conditions captured in a threat scenario. Two conditions are considered in estimating risk: factors associated with the motivation of the attacker and the complexity of the attack. These two factors subsume metrics such as “cost” (e.g., dollars, number of people, and manhours of effort), attacker risk aversion, degree of difficulty, discoverability, ease of access, effectiveness of controls, effort, incentive, interest, skill level, motivation, resources required, risk of detection, and special equipment needed [6, 8] into characteristics about the attacker and characteristics of the attack.

Input values for the factors motivation and complexity condition the likelihood of $P(T)$ as a linear transformation. That is, all things being equal it is assumed that $P(T)$ will be higher if an attacker is highly motivated to exercise the attack. Likewise, $P(T)$ will be lower if an attack is very complex requiring multiple attackers, high monetary cost, and difficult to acquire expertise. Because an analyst may want to put more emphasis on one factor or the other depending on the specific threat instance, TIRA includes a

weighting factor for motivation and complexity. The default for these weights is 50/50.

TIRA models risk:

$$\text{Risk}_j = P(T)(W_M(\text{Motivation}_j) + W_C(\text{Complexity}_j))(\text{Impact}). \quad (2)$$

where:

Motivation = the motivation factor for threat instance j ,

W_M = the weighting factor for Motivation,

Complexity = the complexity factor for threat instance j ,

W_C = the weighting factor for Complexity, and

j is a specific instance of Threat T .

Impact measures the consequences of a successful attack and can be defined as the consequence of loss of integrity, loss of availability, and loss of confidentiality [5]. The analyst assesses impact levels to be High, Medium, and Low, as follows. See Table I. The impact prompt in TIRA is reproduced below.

“Arbitrarily consider one hundred (100) federal elections. Assume a specific voting system configuration, threat countermeasures, controls, and protocols. If this Threat were exercised, for how many of these elections would the impact be low, medium, and high? See table for definitions.”

III. RISK ESTIMATION IN TIRA AND MONTE CARLO

An assumption of TIRA is that we cannot know the “actual” risk of a given threat. The goal of TIRA is to create a rank-ordered list of estimates which express the relative magnitude of each risk. TIRA creates these estimates by having the analyst specify a reasonable range of values for each variable in the model, constructing a sampling distribution, and computing an estimate through repeated sampling using Monte Carlo simulation [7].

Risk estimates produced by TIRA incorporate the natural uncertainty and variance inherent in human/technical systems such as voting systems by constructing sampling distributions based on a reasonable range of values for each variable in the model. The sampling process is repeated thousands of times for each threat instance of each threat tree.

Each sampling run produces an estimate for each of the four variables and computes a value for risk. These computed risk values form a frequency distribution for the entire simulation. The mean of this frequency distribution is used as the risk estimate for that threat. The following sections describe the construction of sampling distributions.

TABLE I. IMPACT LEVELS

Impact Level	Impact Definition
High	A major contest fault, such as in a presidential race or a race that decides partisan majority control in Congress
Medium	A contest fault, such as in a single congressional race or constitutional amendment contest that does not otherwise overly upset national power
Low	Vote errors, aggregation errors, voter disenfranchisement, or loss of voter privacy that, while not causing a contest failure, may nevertheless erode voter confidence

A. Probability of occurrence of $P(T)$:

$P(T)$ is a measure of the analyst’s best estimate of the likelihood that a threat will be successfully exercised. Values for $P(T)$ range from 0 to 1 and establish the relative magnitude of the likelihood of a threat. TIRA assumes that estimates for $P(T)$ are normally distributed ($\sim N$ iid). The three values provided by the analyst, maximum, most likely, and minimum are used to construct a normal cumulative frequency distribution. A cumulative distribution function describes completely the probability of a random event as the cumulative proportion of area under a curve for some value x . A normal distribution was used rather than a triangular distribution because the sponsor of this research wanted the system to utilize, to the greatest extent possible, existing off-the-shelf technology. Excel does not contain a built-in function for a triangular distribution. Therefore, we decided to convert the analyst three estimates to a normal distribution using Excel’s built-in function.

B. Motivation of Attacker:

The variable motivation subsumes characteristics of the attacker such as attacker risk aversion, incentive, interest, and motivation. TIRA models motivation as having a direct relation to $P(T)$. Namely, a threat is more likely to be exercised if an attacker is highly motivated to act.

TIRA prompts the analysts for estimates for motivation with the following text:

“Consider the type of attacker that may exercise this threat. If, arbitrarily, one hundred (100) attackers were to attempt to exercise this threat, how many attackers would be highly motivated, somewhat motivated, and poorly motivated to exercise the attack? Motivation does not refer to the innate motivation of the attacker, but rather how motivated the attacker would be to exercise this attack. Motivation is situational.”

An illustrative cumulative frequency distribution is provided in Table II.

TIRA generates a random number for each run of the simulation for the motivation distribution. If the random number is 0.45, the motivation level will be “somewhat

motivated.” If the random number were 0.93, the motivation level would be “poorly motivated.”

C. Attack complexity.

TIRA models complexity as difficulty of carrying out an attack. The difficulty variable includes factors such as: the number of attackers, effort (time, training etc), financial cost, ease of access, number of insiders and so on. Complexity is modeled as having an inverse relation to P(T). A less complex attack will generally be more likely and a more complex attack less likely. TIRA prompts the analyst for values for complexity with the following text:

“Consider the type of attacker that may exercise this threat. If, arbitrarily, one hundred (100) attackers were to attempt to exercise this threat, how many attackers would find the attack easy, moderately difficult, and very difficult? Consider the type of attacker that may exercise this threat. If, arbitrarily, one hundred (100) attackers were to attempt to exercise this threat, how many attackers would find the attack easy, moderately difficult, and very difficult?”

Assume the analyst indicates 6 attackers will find the attack easy, 20 will find it moderately difficult, and 74 will find it very difficult. The resulting cumulative distribution is shown in Table III. If the simulation generates the random number 0.5, then the complexity level will be “easy”. If the random number were .3, the complexity level would be “very difficult.”

TABLE II. SAMPLE DISTRIBUTION FOR MOTIVATION

Estimation	Level	Cum
(15/100)	Highly motivated (High)	.15
((15+50)/100)	Somewhat motivated (Medium)	.65
((15+50+33)/100)	Poorly motivated (Low)	1

TABLE III. SAMPLE DISTRIBUTION FOR COMPLEXITY

Estimation	Level	Cum
(6/100)	easy (low)	.06
((6+20)/100)	moderately difficult (medium)	.26
((6+20+74)/100)	very difficult (high)	1

D. Impact.

TIRA defines impact as the consequences of a successful attack on the outcome of an election (See Table I). The process for constructing a cumulative frequency distribution for impact is exactly the same as for motivation and complexity. A sample frequency distribution is provided in Table IV.

E. Variable Parameterization.

TIRA asks the analyst to think about their estimate of risk in terms of a reasonable range of values on the scales of (highly, to somewhat, to poorly), (easy, to moderately difficult, to very difficult) and (low, to medium, to high). The

three numerical values are used to construct a cumulative frequency distribution. However, in order to compute a risk estimate, these scales must be parameterized, that is, each level must be assigned a numeric value. Because TIRA produces a unit-less value, the absolute value of the number is arbitrary. TIRA allows the analyst to modify any parameter values.

In TIRA, Motivation is directly related to P(T). There is a higher risk of a threat being exercised if the attacker is highly motivated. The default parameter values for motivation are set to *highly*=2.0, *somewhat*=1 and *poorly*=0.5. The relative magnitude of these values suggests that a very motivated attacker will proportionately double the estimate of P(T). A somewhat motivated attacker will have no impact on the estimate of P(T) and a poorly motivated attacker will reduce the estimate for P(T) by 50%. Again, these parameter values can be dynamically adjusted by the analyst.

Complexity is inversely related to P(T). A rational attacker will seek to minimize cost or difficulty. Therefore, an easy attack is riskier than a difficult one all things being equal. The initial parameter values for complexity are set to *easy*=2, *moderately difficult*=1 and *very difficult*=0.5. Based on the initial parameter values, a very difficult attack will reduce the estimate of P(T) proportionally by half. A moderately difficult attack will have no effect on the estimate of P(T) and an easy attack will proportionally double the estimate of P(T).

TABLE IV. SAMPLE DISTRIBUTION FOR IMPACT

Estimation	Level	Cum
(90/100)	Low impact	.9
((90+9)/100)	Medium impact	.99
((90+9+1)/100)	High impact	1

The initial parameter values for the *Impact* are set to *low*=1, *medium*=2 and *high*=3. These parameters could be set to any arbitrary set of numbers so long as the relative magnitude is maintained.

The minimum value for a risk estimate is 0. The maximum value is 6. So for example, if the value for P(T) and impact is high, the attacker is highly motivated, and the attack is easy, the maximum risk estimate can be obtained with $Risk = 1.0(0.5(2)+0.5(2)3) = 6.0$ using the equation $Risk_j = P(T)(W_M(Motivation_j) + W_C(Complexity_j))(Impact)$.

IV. SENSITIVITY ANALYSIS

A key element in the development of our simulation is assessing the reliability of the risk estimates. Reliability is key if we are to compare risk estimates from one system user to another, creating a common language in the dialogue of risk. For our model, we deemed sensitivity analysis as fundamental to determining reliability. Sensitivity analysis informs us how sensitive our risk estimates are to small changes in input values supplied by the user. That is, no small change in input should cause a disproportionate rise or fall in the value of the response variable.

The traditional way of conducting sensitivity analysis is to hold [n – (n-1)] variables constant and record the resulting

model output while incrementally changing a single variable. However, the number of combinations for our risk model is roughly four million ($C = \frac{n!}{r!(n-r)!}$). Clearly this is infeasible.

Our solution to this challenge was to generate a sufficiently large number of randomly generated sets of input values for variables. Over a sufficiently large number of input sets, we will practically accomplish the same thing as holding a subset constant and manipulating a single value. Our randomly generated sets will include a representative sample of permutations.

Our function for risk is a product of P(T) which is a sample from a normal distribution and an additive component sampled from uniform distributions. The resulting values for risk are created during a Monte-Carlo simulation. Over a large enough number of runs our risk values should take the form of a normal distribution. This stems from the fact that when you multiply a normal distribution by a uniform distribution the result is a shift in the shape of the original normal distribution, in other words it is the mathematical equivalent of multiplying by a constant.

Our assumption is that if the response variable (risk estimate) over many thousands of runs results in a smooth frequency distribution, then all changes in the response variable are proportional to each other. That is, no individual input sets caused a spike in one of the bins of the frequency distribution.

The question of how many runs are needed is an issue of a sample size required to reliably test a hypothesis of a distribution shape. We could calculate the needed sample size; however, computing power is cheaply available for our purposes so we can easily generate an extremely large sample. In our case we choose to have the simulation run 5,000 times, this is the current observation limit for using the Shapiro-Wilks W test in Statistica (note: Shapiro-Wilks W test has become the preferred test due to its superior power properties compared to alternative tests [9]).

V. DATA ANALYSIS

A collection of 5,000 randomly selected input values for TIRA were produced and used to parameterize the Monte Carlo simulation. A screen shot of the input sets is depicted in Figure 2 below.

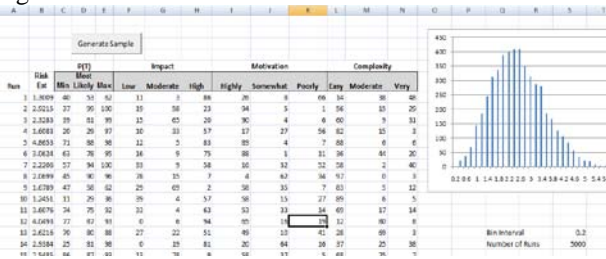


Figure 2: Screen shot of input data

The resulting distribution should be normal in shape and can be tested using the Kolmogorov-Smirnov [10] or the Shapiro-Wilks W test [9]. The hypothesis tested against its null states that the population is not normal. Significant test

statistics mean we should retain the null hypothesis and conclude the distribution in question indeed is not normal. Non-significant test statistics imply a rejection of the null and corresponding conclusion that the distribution is normal.

A Shapiro-Wilks W test was run against the resulting distribution and it was found that the distribution is not normally distributed ($p < 0.000$).

We can see why an exact test for normality is required. In Figure 3 below, the histogram of risk estimates looks relatively smooth or devoid of any disproportion bin sizes. However, if we use Figure 4 we can clearly a deviation from normality in our distribution, resulting from skewed data.

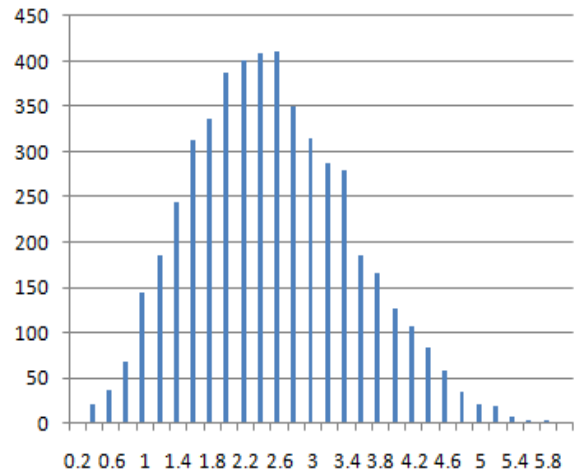


Figure 3: Histogram of risk estimates

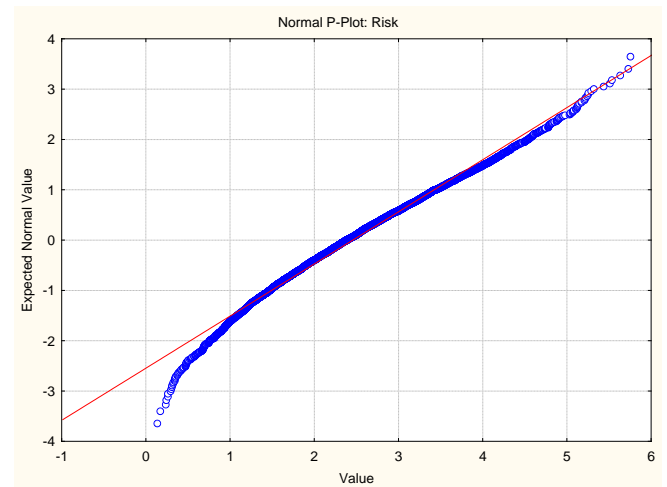


Figure 4: Normal plot of risk estimates

While our hypothesis was not supported, further investigation suggested a reason for this deviation from normality: the default values for the unit-less risk calculation used in TIRA. Risk is computed as a product of likelihood, motivation, complexity, and impact.

With the current initial values for the unit-less risk calculation as described above, risk can vary between 0 and 6. As a measure of likelihood, P(T) varies between 0 and 1.

Thus in every case other than where $P(T) = 1$, multiplying by a fraction will reduce the risk estimate. If we define $P(T)$ analogously to motivation, complexity, and impact (High = 1.0, Medium = 0.5, Low = 0.01), there are 81 unique combinations of these four variables. We calculated the product of each of the 81 combinations and found that over 51% of the combinations of the risk equation result in a risk estimate between 0 and 1 inclusive. Only one combination leads to a risk estimate of 6. This is because two thirds of the possible values for motivation and complexity (0.5 and 1) either reduce the risk estimate or have no effect. One third of the values for impact have no effect on the estimate of risk (where the value is 1). Therefore, over half the combinations of initial values, through multiplication, either reduce or have no effect on the risk estimate. This means that the resulting distribution of the 5,000 runs will tend to skew right because there are a disproportionate number (over half) of combinations of the input values that lead to risk estimates approaching zero.

VI. CONCLUSION

In order for analysts to have confidence in simulation tools, they must produce reliable outputs. TIRA was developed as a tool to facilitate risk assessment of electronic voting systems. The goal of TIRA is to provide a rational quantification of an analyst's intuition or understanding of risk through the calculation of a unit-less risk estimate that captures the relative magnitude of the riskiness of a threat. In order to incorporate the variance and uncertainty inherent in voting systems and the understanding of analysts, TIRA solicits reasonable ranges of values for each variable in the model, constructs a collection of cumulative frequency distributions, and then uses those distributions in a Monte Carlo simulation. The purpose of this paper is to assess the reliability of the resulting risk estimates.

The technique we used to assess reliability was sensitivity analysis. Due to the sheer number of combinations possible with our model, we adopted a simulation approach based on 5,000 runs. Initially we expected a normal distribution with such a large run, but we found a systematic introduction of skewness into our distribution due to the initial values for $P(T)$, motivation, complexity, and impact in TIRA. This paper represents a first attempt at empirically establishing the reliability of our risk estimates. In further studies we will have to account for this skewness in our estimation of normality. A good first start will be to create a larger run of risk estimates; however, a limitation of many non-parametric tests is a limit on the number of observations creating yet another challenge in our sensitivity analysis.

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CONFIDENCE INTERVALS FOR THE MEDIAN IN THE FIRST BUSINESS STATISTICS COURSE

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ABSTRACT

Introductory statistics texts introduce the median as a measure of location that is resistant to outliers and excellent for describing location in data sets that are skewed in shape, such as salaries and house prices. Few introductory texts follow up with inferential methods for the median – no confidence interval procedures for the median are presented. This paper reviews the most common methods for constructing confidence intervals for the median. In addition, these methods are assessed for their suitability for inclusion in the first course.

INTRODUCTION

Most introductory statistics textbooks describe the median, along with the mean, very early in the text as part of descriptive statistics. The median is often contrasted with the mean as a descriptive measure that is resistant to the effects of extreme values or outliers. Here is a brief excerpt from the very popular introductory business statistics textbook, *Essential of Statistics for Business and Economics, 5e*, by Anderson, Sweeney, and Williams [1]:

“Although the mean is the more commonly used measure of central location, in some situations, the median is preferred. The mean is influenced by extremely large and small data values. ... We can generalize to say that whenever a data set contains extreme values, the median is often the preferred measure of central location.”

A quick survey of leading introductory statistics textbooks reveals similar statements in nearly every text.

Most instructors of introductory statistics courses teach students to graph a set of quantitative data with a histogram or stem-plot before blindly calculating summary statistics. David Moore, in his popular text *The Basic Practice of Statistics* [5], commands students to “**Always plot your data**” (his emphasis, not mine). If the data is highly skewed or contains extreme values, it is usually recommended that the students use the median as the descriptive statistic of location (along with the remainder of the five-number summary to describe spread).

However, as the typical one-semester introductory statistics course progresses, no confidence intervals or hypothesis tests based on the median is ever introduced! Students are encouraged to use a statistic that is resistant to the effects of outliers and extreme values, but no practical

inferential methods based upon that statistic are covered in the subsequent chapters of the text. A survey of over twenty one-semester introductory statistics and business statistics texts confirms that this is a commonly omitted topic in these textbooks. Examination of two-semester textbooks and texts targeted toward graduate level students reveals a few texts contain inferential methods for the median, typically as part of a separate chapter on non-parametric statistics, but a simple confidence interval for the median is rarely given.

Why it is a good idea to teach a confidence interval for the median in your intro stats course? Here is a brief list of some of the arguments in favor of including a confidence interval for the median in the first course:

1. It gives students a practical statistical method that can be used to draw conclusions from small, non-normal samples.
2. It gives students a method that is resistant to the effects of a few outliers in the data set.
3. It gives the instructor the opportunity to introduce the concept of nonparametric statistical methods, possibly in anticipation of a second course (or convincing students to take a second elective course).
4. If the method based on the binomial distribution is used, it introduces students to order statistics and gives a useful application of the binomial distribution that your students worked so hard to master.

Why are inferential methods for the median absent from common introductory statistics textbooks? There are numerous methods for calculating confidence intervals for the median. Some of these methods may be too mathematically demanding for introductory statistics courses (which typically require only college algebra as the pre-requisite), but there are undoubtedly methods that could be adapted for easy use by introductory statistics students. The method based upon order statistics and the binomial distribution (already a component of most introductory statistics courses) immediately comes to mind.

BRIEF SURVEY OF METHODS

The many methods available for calculating a confidence interval for the median vary in complexity and notoriety – some are well-known while others are not. There are other competitors to methods based on the median – methods based upon the trimmed mean, M -estimates, and other robust measures of location. These competing methods will not be reviewed here. Further, we restrict the discussion to methods concerning the median whose complexity would not be beyond the ability of the typical introductory statistics student with a college algebra background.

METHOD 1 (binomial distribution, small samples): One of the most basic methods for calculating a confidence interval for the median is based on the binomial distribution. This well-known interval is detailed in a number of sources – see, for example, [6] or [8].

Let X_1, X_2, \dots, X_n be a random sample of size n from a continuous population. Let θ be the median of this population. Put the data in order from least to greatest and let the ordered data be represented as $X_{(1)}, X_{(2)}, \dots, X_{(n)}$ where $X_{(1)}$ is the first number in the ordered list – the smallest value, and $X_{(n)}$ is the last number in the list – the largest value. The $X_{(i)}$'s are called order statistics and the parentheses around the numbers indicate that the values have been ordered from least to greatest.

If the data is a random sample from the target population with median θ , then the observations are independent and the probability that a randomly selected observation is less than θ is 0.5. In other words, for each X_i , $\Pr(X_i \leq \theta) = 0.5$. These two facts are enough for us to use the binomial distribution to calculate a confidence interval for θ . We do not need to make any assumptions about the actual distribution of the population – that makes this procedure a nonparametric method.

Let X be a binomial random variable with parameters n and $p = 0.5$. Solve for the values L and U such that

$$\Pr(L \leq X < U) \approx C$$

where C is the desired level of confidence. Find $X_{(L)}$ and $X_{(U)}$ in the set of order statistics. The interval $(X_{(L)}, X_{(U)})$ is an approximate $C\%$ confidence interval for the median.

Note that it is usually impossible to achieve the exact desired confidence level, C . However, the endpoints of two such intervals with confidence coefficients on either side of the desired C can be combined to form an interpolated interval with confidence coefficient of exactly C , as detailed in [3].

METHOD 2 (normal approximation to binomial, large samples): For larger sample sizes, the binomial distribution can be approximated by the normal distribution with mean np (in this cases, mean $.5n$) and standard deviation $\sqrt{np(1-p)}$ (in this case, $\sqrt{.25n}$). Sort the data into the ordered sample as described above. Calculate the values L and U using

$$L = .5n - z \times \sqrt{.25n}$$

$$U = .5n + z \times \sqrt{.25n}$$

where z is the appropriate percentile from the standard normal distribution. Round L and U up to the next integer. Find $X_{(L)}$ and $X_{(U)}$ in the set of order statistics. The interval $(X_{(L)}, X_{(U)})$ is an approximate $C\%$ confidence interval for the median. [6] and [7] give details of this method.

METHOD 3 (bootstrap methods): A confidence interval for the median can be created using the bootstrap or one of its many variations. A good reference for this and related methods is [4]. An elementary introduction is given in the supplemental chapter of [10].

The bootstrap idea is that since the sample represents the population from which it was drawn, resamples from this sample represent what we might get if we took many samples from the population. The bootstrap distribution of a statistic, based on many resamples, represents the sampling distribution of the statistic, based on many samples.

Bootstrap statistics are based on the “plug-in principle” – estimate a parameter using the statistic that is the corresponding value for the sample. The bootstrap standard error (SE_{boot}) of a statistic is the standard deviation of the bootstrap distribution of that statistic.

Here is the procedure: Resample from the sample many times, say N . For each of the N resamples, calculate the value of the median. Find the standard deviation of the N resampled medians – this is SE_{boot} . Form the bootstrap t confidence interval as

$$median \pm t \times SE_{boot}$$

where t is the appropriate percentile from a t -distribution with $n - 1$ degrees of freedom.

As noted in [10], difficulties occur when bootstrapping the median for small sample sizes. Other variations of the bootstrap are possible – bootstrap percentile intervals, bootstrap bias-corrected accelerated intervals, and bootstrap tilting intervals are a few – but these variations will not be discussed here.

METHOD 4 (Wilcoxon): The Wilcoxon signed rank test is a nonparametric method for testing a hypothesis concerning the location of a single sample. The procedure can be modified to yield a confidence interval for the median as detailed in [7]. This procedure is not detailed here, as the complexity of the calculations would be quite frustrating to a typical intro statistics student. The method is mentioned because the confidence interval can be generated by several commonly available, user-friendly software packages, Minitab and StatCrunch.

MEDIAN METHODS IN TEXTBOOKS

While an exhaustive review of the available introductory texts for statistics and business statistics was not conducted, I would like to briefly discuss a few specific titles. The binomial distribution method (method 1) is given in the recent business statistics textbook by Stine and Foster [11]. As far as I know, this is the only current introductory text that explicitly details the binomial distribution method. The two-semester text of Anderson, Sweeney, and Williams [2] has a chapter on nonparametric statistics. In end-of-section notes, method 1 and method 4 are mentioned as being available in Minitab, but no details of the computations are given except to say that the normal approximation is used. The text by Moore and McCabe [10] has a supplementary chapter on bootstrap and permutation methods where method 3 is discussed. A number of other introductory two-semester texts have a chapter on nonparametric methods, but the focus is always on hypothesis tests with no mention of corresponding confidence interval procedures.

MEDIAN METHODS IN POPULAR SOFTWARE

Unfortunately, many common statistics software packages, such as SPSS and SAS, do not contain any of the methods discussed above. These methods must often be implemented by writing a macro to carry out the required calculations. While that is certainly possible for graduate students and statistics majors, it is beyond what is normally expected of an intro statistics student.

The popular software package Minitab offers the binomial-based intervals in two places, as part of the “graphical summary” and as an option of the sign-test procedure. In addition, Minitab’s sign-test procedure uses the non-linear interpolation of Beran and Hall [3] to achieve the exact desired level of confidence. Minitab also offers the method 4 as part of the Wilcoxon signed rank procedure.

The web-based statistics software StatCrunch offers the binomial-based interval as an option in the sign-test and offers method 4 as an option in the Wilcoxon signed-rank procedure.

The software S-PLUS offers the S+Resample library. This software makes the calculations of method 3 menu-driven and very straightforward. The S+Resample library is offered free with the text by Moore and McCabe [10].

Spreadsheets are used as the primary computing environment in many intro courses. It is relatively simple to perform the calculations for the methods based on the binomial distribution and normal approximation to the binomial in an Excel spreadsheet, which is familiar ground to many students.

CHOOSING AMONG THE OPTIONS

For instructors wishing to add confidence intervals for the median to their syllabus, a decision must be made about which method or methods to teach. For some instructors, the choice is easy. For example, instructors using ideas from the “randomization-based curriculum” advocated by Cobb [5], method 3, based upon the bootstrap, (or some variation of method 3) is the natural choice.

For instructor’s who have chosen to use Minitab or StatCrunch as the primary computing environment in their course, choosing one of the methods available in that software package seems very reasonable. In fact, these two software packages are so simple to use, students will find the introduction of these confidence intervals quite painless.

Some instructors believe in avoiding software for all but the most complex of calculations. Methods 1 and 2 are most amenable to hand calculations. For small sample sizes, a table of binomial distributions, which is available in the appendix of most texts, makes the calculations involved in method 1 very straightforward. For larger sample sizes, a standard normal distribution table is all that is needed to calculate the interval of method 2.

AN ADDED BONUS

Methods 1, 2, and 3 can be modified to produce confidence intervals for quantiles other than the median. The extension is straightforward and makes a suitable challenge problem for bright students.

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Making Statistics More Effective in Schools of Business: Tips for Statistics Instruction (Things That Have Worked or Not Worked)

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ABSTRACT

This session will be an open interactive moderated discussion and sharing among the presenters and those attending. The session will provide an opportunity for experienced teachers to share things they have tried either successfully or unsuccessfully to improve the quality of student learning in their classes. Areas of focus will include but not restricted to understanding the “big picture” for a topic and not getting lost in mechanical calculations; understanding that statistical knowledge will be useful in the future; motivating students in the statistical topic areas of Tables and Charts, Descriptive Statistics, Probability Distributions, Confidence Intervals, Hypothesis Testing, and Regression.

SESSION OVERVIEW

The goal is to engage those attending and to try to provide information of value to participants. All participants, presenters and those attending, will be encouraged to interact by asking questions and sharing their knowledge. The presenters will each address an area where they have tried to improve learning for their statistics students. They will share things that have been successful for them and possibly some things that were not successful.

One big challenge is to get students to look at the statistics class as more than just a hurdle that must be jumped in order to get a degree and can be forgotten about once the hurdle is cleared.

Getting them to believe that statistical knowledge and understanding is important for future classes and in a professional career will be more likely to get them engaged in truly learning the material and not just memorizing enough to pass the tests and the course. This leads to the next challenge of how one can best get the students beyond memorizing and regurgitating. The goal is to get them to truly see the “big picture” and to understand the statistical thinking involved rather than merely being able to replicate a set of steps that will get the answers to the problems that will be on the test. Students need to understand how to properly use the techniques they learn and the consequences of improperly using them. We may differ somewhat in certain areas but hopefully all would agree that critical knowledge for a business undergraduate student to retain from an entry level statistics course is an understanding of the concept of using sample data to draw inferences about the population parameters being studied.

In addition to addressing the big picture concepts the session will address specific topics covered in most business statistics classes:

Tables and Charts
Descriptive Statistics
Probability Distributions
Confidence Intervals
Hypothesis Testing
Regression.

Sharing things that work well when teaching these topics can be valuable but an equally important or maybe even more important issue that will be presented are traps or pitfalls to avoid in teaching these topics..

ARE WE TEACHING WHAT WE KNOW OR WHAT THE STUDENTS NEED FOR THEIR FUTURE?

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ABSTRACT

As faculty we often want to perform well in the classroom, but our goal should be to prepare the students for their academic and professional futures. As faculty, how do we move from being the “sage on the stage” to be the “guide on the side?” As guides we need to have a correct knowledge of the desired destination and clearly articulate it to the students. We also need to decide on the best destination for those we are guiding. The Gaise Report recommendations and a summary of discussions with practicing professionals will be presented as suggestions for what students need for their future. The session will be an open interactive moderated discussion and those attending along with the presenters will be encouraged to participate

SESSION OVERVIEW

This session will have an interactive discussion of what and how we instruct in introductory statistics classes. When called on to perform well one naturally wants to go to the things we know best and do best. Student evaluations of faculty cause us to focus on performing well. However we should not lose sight of the fact that the main purpose of an education is to better prepare the students for the future. With that in mind then one should not be focused on performing well but should be focused on preparing students to perform well after they finish the current course. The focus causes an instructor to ask what the students for classes that follow and most importantly for their professional future.

One can use the topics in existing business statistics textbooks as a guideline for what should be taught in a course, but in reality these do not reflect the leading edge of statistics education. One resource of value to consider is the report from the introductory college courses of the American Statistical Association funded Guidelines for Assessment and Instruction in Statistics Education (GAISE) Project. The six Gaise College Report recommendations are:

1. Emphasize statistical literacy and develop statistical thinking
2. Use real data
3. Stress conceptual understanding, rather than mere knowledge of procedures

4. Foster active learning in the classroom
5. Use technology for developing conceptual understanding and analyzing data
6. Use assessments to improve and evaluate student learning

These recommendations are for statistics in general and not uniquely for business students. The students in our business statistics classes will most likely be headed for a wide variety of futures. Some may go into research in a business discipline and use statistics for this research, but a much larger group will work in a business or non-profit organization. With the advances of technology both business and non-profit organizations are able to record large amounts of transactional data for their operations and processes. Also the amount of other relevant data for decision making is continuing to increase. The book *Competing on Analytics* by Davenport and Harris in 2007 illustrates how data can be used effectively for making business decisions and brought “business analytics” up the status of being a functional area in business. We argue that this should have implications for what and how we think about the introductory business statistics class.

At Virginia Commonwealth University faculty in the decision sciences area tried to identify a set of necessary skills for business analytics. After a series of discussions with analytics professionals, including representatives from IBM and Capital One, the following set of skills was developed:

- Work in a collaborative environment.
- Translate a specific business question into a problem that can be solved using appropriate data.
- Acquire and organize appropriate data so that it can be used for analysis.
- Know general principles and common tools and be able to apply them to analyze specific business problems.
- Develop and effectively communicate an actionable solution for the specific business question.

The above skills are mainly for business analytics but analytics involves analysis of data and decision making involving parameters of data distributions in a business context. These are also fundamentals of business statistics. The large amounts of data mean that statistical significance will not be as important. One should also be discussing practical significance in addition to statistical significance. Also focus should be given to identifying what would be appropriate data to answer a specific business question.

Story Telling for Teaching Statistics

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ABSTRACT

What can we do as teachers to improve student retention of the essential statistical instruction in the classroom? Focusing instruction on mere knowledge of statistical procedures promotes memorizing, downloading for the test and memory erasing. This session will discuss putting the instruction in the form of a story to provide something that will be more readily retained by students. Aesop's Fables and the parables of Jesus have been effective tools for instruction for centuries so why can't story telling be effective for statistics instruction? The session will be an open interactive moderated discussion and those attending along with the presenters will be encouraged to participate.

SESSION OVERVIEW

This session will begin with the panelists telling how they have framed a story as a part of their classroom instruction. Stories may vary from focused to more general. A specific story may illustrate a particular point or concept. A more comprehensive story may be about a bigger context for analysis. Time will also be allotted for interactive discussion among the audience and the presenters.



Cloud Computing:

A newer phenomenon in the IT segment of Supply Chain

This document contains information on what Cloud Computing is, how it works and the benefits that businesses will gain with it when they overcome the obstacles associated with it.

Christopher Taylor
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Executive Summary of the Report

This report provides an explanation as to what the term "Cloud Computing" means and its applications in the business world. It begins by starting out with some simple terminology to get the reader acquainted with Cloud Computing, followed by a bit of history on the topic.

From there, the report continues into the summary of article findings which discuss the key points and issues that relate to Cloud Computing. These start from the economic standpoint and proceed to go through a number of obstacles that a business will run into when trying to implement Cloud Computing. Instead of leaving the reader with questions on how to address the issues, opportunities on how to correct the problems are also a part of the obstacles section.

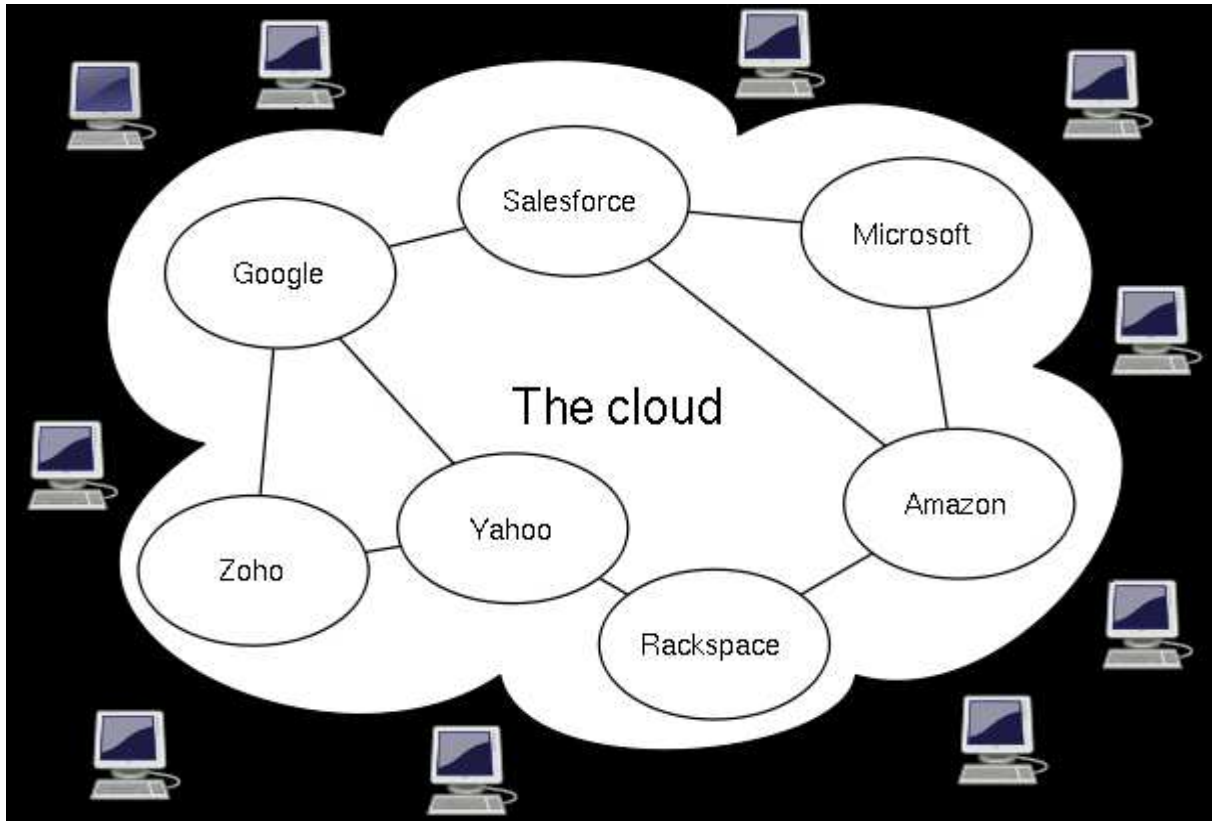
The next two sections cover the topic on how it can be applied to businesses and where it already has been applied. Both of these sections cover a few articles that give details that pertain to each of the titles of the sections that they cover.

Finally, the last section is the conclusion of the report followed by three recommendations that the reader will understand and relate with after reading through the entire report.

What exactly is Cloud Computing?

Cloud computing is internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, similar to that of the electricity grid. In the diagram below, the concept of Cloud Computing is laid out in a visual representation to help have a further understanding of what exactly Cloud Computing looks like.

Figure 1- Visual representation of the concept of Cloud Computing



-Johnston, Sam. March 2009. http://en.wikipedia.org/wiki/File:Cloud_computing.svg

Certain details are abstracted from the users, who no longer have need for the technology infrastructure "in the cloud" that supports them. What this statement means, is that the user no longer needs to have a complex computer in-house. The computer will have minimal operating needs to function. This means not needing a hard drive, having a less advanced motherboard, a processor chip that doesn't consume a large amount of resources, et cetera. Cloud computing describes a new supplement, consumption, and delivery model for IT services based on the Internet. It is a byproduct of the ease-of-access to remote computing sites provided by the Internet. This frequently takes the form of web-based tools or applications that users can access and use through a web browser as if it were a program installed locally on their own computer.

The term "cloud" is used as a metaphor for the Internet. This is based on the cloud drawing used in the past to represent the telephone network, and now to depict the Internet in computer network diagrams, as an abstraction of the underlying infrastructure it represents. Typical cloud computing providers deliver common business applications online that are accessed from web browsers, while the

software and data are stored on servers. Clouds often appear as single points of access for all consumers' computing needs.

History

"Computation may someday be organized as a public utility".

-John McCarthy

The actual term "cloud" as stated before, is a borrowed concept from telecommunications companies. These companies initially offered dedicated point-to-point data circuits as their means of transmitting data. This was expensive luxury that only a few companies could afford to pay for. Sometime in the early to mid 1990's these companies began offering Virtual Private Network (VPN) services. VPNs are a way of allowing businesses to have a secure connection from individual users to the business's private network using a public telecommunication interface or simply the internet. These VPNs were comparable in quality of service to the old dedicated point-to-point data circuits but the costs associated with them were much lower. By having the ability to switch traffic to balance utilization as they saw fit, the businesses were able to utilize their overall network bandwidth more effectively. The cloud symbol was used to denote the point at which the responsibility of the provider was shifted from them to that of the user. Cloud computing extends this boundary to cover servers as well as the network infrastructure.

Amazon played a key role in the development of cloud computing by modernizing their data centers after the dot-com bubble in the early 2000s. Most computer networks during this time were using as little as 10% of their capacity at any one time just to leave room for occasional spikes. Having found that the new cloud architecture resulted in significant efficiency improvements, small fast-moving teams were created. This allowed Amazon to add new features faster and easier. Amazon started providing access to their systems through Amazon Web Service (AWS) on a utility computing basis in 2006.

In 2007, a number of universities along with Google and IBM embarked on a large scale cloud computing research project. In early 2008, Eucalyptus became the first open source AWS API (Amazon Web Service and Application Programming Interface) for deploying private clouds. By mid-2008, Gartner saw an opportunity for cloud computing "to shape the relationship among consumers of IT services, those who use IT services and those who sell them", (Schurr 2008) and observed that "organizations are switching from company-owned hardware and software assets to per-use service-based models" so that the "projected shift to cloud computing ... will result in dramatic growth in IT products in some areas and significant reductions in other areas." (Gartner 2008)

Summary of Research Findings

Economics

Upon doing some research involving the economics aspect of cloud computing, three compelling cases that favor utility computing over conventional hosting appeared. The first case is when demand for a service varies with time. For example, a data center must be able to endure during both its peak load time and its underutilized days each month. Instead, cloud computing lets an organization pay by the hour for computing resources, potentially leading to cost savings, even if this means that the hourly rate to rent a machine from a cloud provider is higher than the rate to own one. A second case deals with demand being unknown in advance. For example, a Web startup will need to support an increase in demand when it becomes popular followed by a reduction once its popularity falls. Finally, organizations that perform batch analytics (Amazon provides a service like this called Amazon Elastic Compute Cloud

or EC2) can use the cost associated with cloud computing to finish computations faster. What this means is that the number of machines and machine hours can be interchanged. To illustrate this point, a company using 1,000 EC2 machines for one hour costs the same as using one machine for 1,000 hours.

Although the economic appeal of cloud computing can often be looked at as converting capital expenses to operating expenses, the phrase "pay as you go" or "pay for what you use" directly captures the economic benefit to the buyer. Hours purchased by the means of cloud computing can be distributed over time. Here is a good example of how it works. A company could use 200 server-hours over the course of one day and no server-hours the following day, and still pay only for 200 server-hours. In the networking community, this way of selling bandwidth already exists as usage-based pricing. In addition to the absence of the up-front capital expense, this allows capital to be redirected to the core business investment.

Therefore, even if Amazon's "pay-as-you-go" pricing was more expensive than buying and depreciating a comparable server over the same period, it can be argued that the cost is outweighed by the economic benefits of elasticity and the transference of risk.

Top 10 Obstacles and Opportunities for Cloud Computing

Table 1 Summary of Obstacles and Opportunities

Obstacle	Opportunity
1 Availability/Business Continuity	Use Multiple Cloud Providers
2 Data Lock-In	Standardize APIs; Compatible SW to enable Surge or Hybrid Cloud Computing
3 Data Confidentiality and Auditability	Deploy Encryption, VLANs, Firewalls
4 Data Transfer Bottlenecks	FedExing Disks; Higher BW Switches
5 Performance Unpredictability	Improved VM Support; Flash Memory; Gang Schedule VMs
6 Scalable Storage	Invent Scalable Store
7 Bugs in Large Distributed Systems	Invent Debugger that relies on Distributed VMs
8 Scaling Quickly	Invent Auto-Scaler that relies on ML; Snapshots for Conservation
9 Reputation Fate Sharing	Offer reputation-guarding services like those for email
10 Software Licensing	Pay-for-use licenses

-<http://deliveryimages.acm.org/10.1145/173000/1721672/figs/t2.jpg>

Table 1 summarizes the list of critical obstacles to growth of cloud computing. The first three affect adoption, the next five affect growth, and the last two are policy and business obstacles. Each obstacle is paired with an opportunity to overcome that obstacle, ranging from product development to research projects.

1. Business Continuity and Service Availability

Organizations worry about whether utility computing services will have adequate availability, which makes it obstacle number one against cloud computing. Ironically, existing Software as a Service (SaaS) products have already set a high standard in dealing with this topic. Technical issues of availability aside, a cloud provider could suffer outages for nontechnical reasons, including going out of business or being the target of regulatory action.

Although cloud vendors do not offer specialized hardware and software techniques in order to deliver higher reliability, they could do so by offering that service at a higher price. This reliability could then be sold to users as a service level agreement. But this approach only goes so far. The high-availability computing community has long followed the phrase "no single point of failure," yet the management of a cloud computing service by a single company is just that. Even if the company has multiple data centers in different geographic regions using different network providers, it may have common software infrastructure and accounting systems, or the company may even go out of business. Large customers will be reluctant to migrate to cloud computing without a business-continuity strategy for such situations.

The best chance for independent software stacks is for them to be provided by different companies, as it has been difficult for one company to justify creating and maintain two stacks in the name of software dependability. Just as large Internet Service Providers (ISP) use multiple network providers so that failure by a single company will not take them off the air, the only plausible solution to very high availability is multiple cloud computing providers.

2. Data Lock-In

Software stacks have improved interoperability among platforms, but the storage APIs for cloud computing are still essentially proprietary, or at least have not been the subject of active standardization. What this means is that customers cannot easily take their data and move it from one site to another. Concern about the difficulty of extracting data from the cloud is preventing some organizations from adopting cloud computing. Customer lock-in may be attractive to cloud computing providers, but their users are vulnerable to price increases, to reliability problems, or even to providers going out of business.

One solution would be to standardize the APIs in such a way that a SaaS developer could deploy services and data across multiple cloud computing providers so that the failure of a single company would not take all copies of customer data with it. One might worry that this would lead to a "race-to-the-bottom" of cloud pricing and flatten the profits of cloud computing providers. There are two arguments to lessen this fear.

First, the quality of a service matters just as much as the price to some customers. This means they may not jump to the lowest-cost service. Some ISP's today cost an upwards of 10 times more than others due to more dependability and the extra services that are offered to improve usability. Second, in addition to mitigating data lock-in concerns, standardization of APIs enables a new usage model in which the same software infrastructure can be used in an internal data center and in a public cloud. Such an option could enable hybrid cloud computing or surge computing in which the public cloud is used to capture the extra tasks that cannot be easily run in the data center (or private cloud) due to temporarily heavy workloads. This option could significantly expand the cloud computing market.

3. Data Confidentiality/Audit-ability

Despite the fact that most companies outsource significant and confidential internal services such as payroll and email to external vendors, security is often one of the most frequently used objections to cloud computing. In order to combat this objection, a requirement for audit-ability will be put in place. The Sarbanes-Oxley and Health and Human Services Health Insurance Portability and Accountability Act (HIPAA) regulates that all data that is provided to the cloud is to be secured and checked frequently for mistakes through the use of many auditing tools that are available.

Cloud users face security threats both from outside and inside the cloud. Many of the security issues involved in protecting clouds from outside threats are similar to those already facing large data centers. In the cloud, however, this responsibility is divided among potentially many parties, including the cloud user, the cloud vendor, and any third-party vendors that users rely on for security-sensitive software or configurations.

The cloud user is responsible for application-level security. In layman's terms, the user takes ownership for the program they are utilizing on the computer they are using. The cloud provider is responsible for physical security, and for enforcing external firewall policies. This means they take physical ownership of the data while it's on their server and prohibit other unauthorized users from accessing it. Security for intermediate layers of the software stack is shared between the user and the operator. The lower the level of abstraction exposed to the user, the more responsibility goes with it. This user responsibility, in turn, can be outsourced to third parties who sell specialty security services. By having standardized interfaces of platforms like EC2, it will make it possible for a company to offer configuration management or firewall rule analysis as value-added services.

While cloud computing may make external-facing security easier, it does pose the new problem of internal-facing security. Cloud providers must guard against theft or denial-of-service attacks by unauthorized users. Users also need to be protected from one another.

The primary security mechanism in today's clouds is virtualization. It is a powerful defense, and protects against most attempts by users to attack one another or the underlying cloud infrastructure. However virtualization environments are not "fool-proof". Virtualization software has been known to contain bugs that allow virtualized code to no longer be protected. Incorrect network virtualization may allow unauthorized users access to sensitive portions of the provider's infrastructure. Any large Internet service will need to ensure that a single security threat doesn't compromise the entire system as a whole.

One last security concern is protecting the cloud user against the provider. The provider will control the "bottom layer" or the point at the software stack where the data is stored in its most basic form. This means they will have complete access to the data which in return effectively circumvents practically all security techniques. Without improvements in security technology, it is expected that the law will be involved to guard against provider malfeasance.

Similarly, audit-ability could be added as an additional layer beyond the reach of the virtualized guest OS, providing facilities arguably more secure than those built into the applications themselves and centralizing the software responsibilities related to confidentiality and audit-ability into a single logical layer. Such a new feature reinforces the cloud computing perspective of changing the focus from specific hardware to the virtualized capabilities being provided.

4. Data Transfer Bottlenecks

Applications will continue to become more and more data-intensive. If we assume applications could be segmented across the boundaries of clouds, this will complicate data placement and transport. If the costs of \$100 to \$150 were used to show pricing per terabyte transferred, these costs could quickly add up, making data transfer costs an important issue. Cloud users and cloud providers have to think about the implications of placement and traffic at every level of the system if they want to minimize costs.

One opportunity to overcome the high cost of Internet transfers is to simply ship the disks. While this does not address every use case, it effectively handles the case of large delay-tolerant point-to-point transfers, such as importing large data sets. The research below is used to demonstrate transfer costs vs. shipping costs.

"To quantify the argument, assume that we want to ship 10TB from U.C. Berkeley to Amazon in Seattle, WA. Garfinkel measured bandwidth to S3 from three sites and found an average write bandwidth of 5Mbits/sec to 18Mbits/sec. Suppose we get 20Mbits/sec over a WAN link. It would take

$10 * 10^{12} \text{ Bytes} / (20 \times 10^6 \text{ bits/second}) = (8 \times 10^{13}) / (2 \times 10^7) \text{ seconds} = 4,000,000 \text{ seconds},$

which is more than 45 days. If we instead sent 10 1TB disks via overnight shipping, it would take less than a day to transfer 10TB, yielding an effective bandwidth of about 1,500Mbit/sec." (A View Cloud Computing April 2010)

5. Performance Unpredictability

It has been discovered that certain components of virtual machines work well in cloud computing while others can be problematic. CPUs and main memory work well in cloud computing, but network and disk I/O sharing are more problematic. Featured below is an excerpt of an experiment that was conducted by researchers from the UC Berkeley.

As a result, different EC2 instances vary more in their I/O performance than in main memory performance. We measured 75 EC2 instances running the STREAM memory benchmark.¹⁴ The mean bandwidth is 1,355Mbytes/sec., with a standard deviation across instances of just 52MBytes/sec, less than or about 4% of the mean. We also measured the average disk bandwidth for 75 EC2 instances each writing 1GB files to local disk. The mean disk write bandwidth is nearly 55Mbytes per second with a standard deviation across instances of a little over 9MBytes/sec, or about 16% of the mean. This demonstrates the problem of I/O interference between virtual machines.

One opportunity is to improve architectures and operating systems to efficiently virtualize interrupts and I/O channels. Another possibility is that flash memory will decrease I/O interference. Flash is semiconductor memory that preserves information when powered off like mechanical hard disks, but since it has no moving parts, it is much faster to access (microseconds vs. milliseconds) and uses less energy. Flash memory can sustain many more I/Os per second per gigabyte of storage than disks, so multiple virtual machines with conflicting random I/O workloads could coexist better on the same physical computer without the interference we see with mechanical disks.

6: Scalable Storage

As a reminder, there are three properties when combined, give cloud computing its appeal. They are (1) short-term usage, (2) no upfront cost, and (3) infinite capacity on demand. While it's meaning is straightforward when applied to computation, it's less clear how to apply it to persistent storage.

The opportunity is still being debated. The ultimate idea behind this principle is to create a storage system that would not only meet existing programmer expectations in regard to durability, high availability, and the ability to manage and query data, but also combine them with the cloud advantages of scaling arbitrarily up and down on demand.

7: Bugs in Large-Scale Distributed Systems

One of the most difficult challenges facing cloud computing is removing errors in large-scale distributed systems. A common occurrence is that these bugs cannot be reproduced in smaller configurations, so the key in debugging must occur in the production data centers.

One opportunity may be to rely on virtual machines (VM) more in cloud computing. Many traditional SaaS providers developed their infrastructure without using VMs. There are two reasons. The first deals with an inconsistency with time. The providers developed their programs before the popularity of VMs. The second dealt with cost and not having the resources available to make them. Since VMs are the "all mighty" in utility computing, that level of virtualization may make it possible to capture valuable information in ways that are implausible without VMs.

8: Scaling Quickly

"Pay-as-you-go" definitely applies to storage and to network bandwidth. Both count the data or bytes used. However, computation is slightly different, depending on the virtualization level. For instance, Google AppEngine automatically scales in response to load increases and decreases, and users are charged by the cycles used while AWS charges by the hour for the number of instances you occupy, even if your machine is idle.

The opportunity then lies in the ability to automatically and quickly scale up and down in response to load in order to save money, but doing so without violating service level agreements. Another reason for scaling is not only to conserve money but resources as well. Since an idle computer uses about 65% of the power of a busy computer, careful use of resources could reduce the impact of data centers on the environment. Cloud computing providers already perform careful and low-overhead accounting of resource consumption. By imposing fine-grained costs, utility computing encourages programmers to pay attention to efficiency (that is, releasing and acquiring resources only when necessary), and allows more direct measurement of operational and development inefficiencies.

Being aware of costs is the first step to conservation, but configuration hassles make it tempting to leave machines idle overnight so that startup time is zero when developers return to work the next day. A fast and easy-to-use snapshot/restart tool like ghosting may further encourage conservation of computing resources.

9: Reputation Fate Sharing

The old expression "Bad company corrupts good morals" can be applied here. If one customer causes bad behavior the end result can affect the reputation of others using the same cloud. For instance,

blacklisting of IP addresses (blocking the IP from accessing the cloud in layman's terms) by spam-filtration may limit the accessibility and functionality of applications. An opportunity would be to create reputation-guarding services which would (for a small fee) make claims that your cloud has a great reputation based on a number of facts and statistics.

10: Software Licensing

Current software licenses commonly restrict the computers on which the software can run. Users pay for the software and then pay an additional annual maintenance fee. Hence, many cloud computing providers originally relied on open source software in part because the licensing model for commercial software is not a good match to utility computing.

The primary opportunity is either for open source to remain popular or simply for commercial software companies to change their licensing structure to better fit cloud computing.

Description of how the findings can applied in a company

"ReliaCloud, a national cloud computing infrastructure company, has launched a full channel program centered on their enterprise-class infrastructure-as-a-service (IaaS) cloud computing offering. Enterprise and small business IT spending is moving more and more to the cloud due to its easier set up, scalability, flexibility, built-in maintenance and support, and reduced costs for hardware and software maintenance." (Reliacloud, 2010)

The paragraph above demonstrates how a company can get over the obstacles associated with Cloud Computing. Small businesses are heading towards "the cloud" to reduce costs (which was discussed in obstacle 1), and reduce for hardware and software maintenance (covered in a number of obstacles). To continue further, the article states,

"ReliaCloud will make the reseller process as easy as possible, by providing a suite of tools that supports their resale process. ReliaCloud has developed a series of programs that maximize the use of their Cloud Storage and Cloud Servers for each of their customer profiles. Value Added Resellers (VARs) have the ability to bundle ReliaCloud with their existing technical offerings to deliver a combined solution. ReliaCloud partners receive best in class sales and marketing support including marketing collateral, video tutorials and cooperative marketing funds." (Reliacloud, 2010)

The above paragraph refers to obstacles 3, 7, 9 and 10 that have been overcome. To finish the article, ReliaCloud goes on to share how their product will differ from the competition.

While there are similar programs in the market today, the major point of differentiation for ReliaCloud is the customer service aspect. Many partners have suggested that some of the more well know cloud providers don't demonstrate that they understand the support needs of SMB partners. ReliaCloud gives each partner direct access to an assigned channel manager.

"We are excited to launch a program that allows managed service providers the opportunity to expand their business by offering cloud services," says Brian Stevenson, Vice President of Sales for ReliaCloud. "We expect IT consulting firms and managed service providers to be the driving force of cloud adoption." (ReliaCloud, 2010)

Analysis of how well the topic has been accepted and applied in business

There is really no better way to show how well Cloud Computing has been accepted and applied successfully in a business than to discuss a company that has won an award for "Best Practices" in the Virtualization and Cloud Computing category. The most ironic part behind the winner though is the fact that it would not be a company you would associate virtualization with. The company that won the SNW's Spring 2010 "Best Practices" Award in Virtualization and Cloud Computing category is non-other than Kelley Blue Book. KBB is the leading provider of new and used car information. Below is an excerpt from the article:

Kelley Blue Book's rapid technological expansion required the development of a more scalable and flexible storage networking solution. With the help of systems integrator Trace3, the company implemented a powerful core infrastructure with VMware software and NetApp storage. By implementing de-duplication software from NetApp, storage utilization decreased by over 70 percent and enabled the company to add more virtual machines per volume than ever before. By increasing the size of storage aggregates and defining different tiers of disk resources, Kelley Blue Book boosted performance by 400 percent.

"With the software and storage technology Kelley Blue Book has implemented our engineers can expand and configure storage and provision virtual environments quickly, without requiring a redesign or lengthy provisioning times," said Grant Leathers, director of enterprise infrastructure for Kelley Blue Book. "In addition to this we have simplified maintenance, increased utilization, improved performance and postponed storage acquisition costs." (Kelley Blue Book ,2010)

A little bit of background about the Best Practices Award Program. It identifies and acknowledges excellence among users of storage IT solutions and approaches in the following categories: Best Practices in Green Computing, Energy Efficiency and the Data Center; Best Practices in Planning Designing and Building a Next Generation Storage and Server Infrastructure; Best Practices in Storage Resiliency, Data Protection and Recovery; Best Practices in Technology Innovation and Promise; Best Practices in Virtualization and Cloud Computing.(Kelly Blue Book, 2010)

Conclusions and Recommendations

It is predicted that cloud computing will continue to grow. Regardless of whether a cloud provider sells services at a low level of abstraction like Amazon's EC2 or a higher level like Google's AppEngine; computing, storage, and networking must all focus on becoming more horizontal in terms of structure rather than being a single node. My recommendations are:

1. Application software needs to become more scalable in terms of speed, storage, and pricing.
2. Infrastructure software needs to be produced to run on VM's.
3. Hardware systems should be designed with energy efficiency in mind and replace parts that do not work well with VM. An example would be replacing standard memory with Flash memory and the reasons for it were explained earlier.

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**Balancing Work with Life: A Look at Alternate
Scheduling in the Long-Term Health Care Industry**

Track – Student Papers

Abstract

Within the long-term health care industry, there are still many companies that adhere to a strict 1st, 2nd, or 3rd shift work schedule. With alternative work scheduling options, employees with other interests and commitments outside of work are likely to leave an inflexible work environment for a company that acknowledges life outside of work. More often, the decision to respond to work and personal balance issues is driven by bottom-line implications. An employee who is highly satisfied translates into high morale on the job and in turn, positively impacts productivity, training, and service. In turn, managers must provide an adequate amount of 'coverage' to clients in a facility while filling an inflexible amount of hours without holidays or breaks in the schedule. While not all arrangements work equally well in every environment, an increasing number of long-term health care organizations are willing to test diverse work options and some are reporting positive results.

Introduction

Long-term care refers to health services provided to chronically ill, aged, or disabled patients on a continuing and lengthy basis. Care typically takes place in nursing facilities, assisted living residences, and homes for individuals with specific mental capabilities or developmental disabilities. There has been great attention given to the aging of “baby boomers” and to the rapidly growing population over the age of 75 where the need for long-term care has increased.

The most common health care occupations found in long-term care are that of the Certified Nursing Assistant (CNA), the Licensed Practical Nurse, and the Registered Nurse (U.S. Health & Human Services, 2003). Some facilities also employ Resident Assistants, who provide direct personal care services to residents but are not certified as CNAs. Qualified Medical Assistants may also assist with the administration of medication and treatment. Most of these positions serve patients directly, working with individuals, their illness or problem and their family. These front-line workers provide hands-on care, supervision, and emotional support to millions of elderly and younger people with chronic illness and disabilities.

In health care organizations, employees want to be intrinsically happy with their work and career but also want to be happy with their lives. Managers do not want their workers to be preoccupied with personal issues to a point that it interferes with their ability to concentrate during their workday. Managers want to lead committed and productive workers towards the overall organizational goals, reduce costs and increase profit margins (Luthans, 2008). All of these long-term goals can be achieved and yet,

every part of the organization should have these same goals in mind but usually do not because each employee has their own individual short-term goals.

Frontline worker jobs in long-term care are viewed by the public as mostly unpleasant occupations - taking care of incontinent, cognitively unaware old people. This image is often portrayed in media reports that feature poor quality care by some providers.

In creating a positive “corporate culture” for a facility, managers must recognize which managerial style is acceptable towards employees at specific instances in order to keep the organization focused on the overall goals (Luthans, 2008). A manager must use a combination of interpersonal styles using assertive or cooperative methods with subordinates. Part of those cooperative methods may be allowing their employees to take advantage of alternative work scheduling. Such flexible scheduling can help employees meet their personal needs while keeping them focused on their obligations to the organization. In the health service industry, there must be an adequate amount of staff on duty for every shift at a facility or workers during those particular shifts will be overworked and resent those who are not at work during their presupposed times.

In order to have workers who are satisfied and committed to an organization, management must recruit and retain those individuals who exhibit the behaviors and attitudes that are consistent with the organization’s norms and goals. Low wages and benefits, and a job that has been negatively stigmatized by society make such recruitment and retention difficult for managers. In this paper, I examine this situation in more depth by beginning with a background on the nature of the work involved for certified nursing assistants. Next, I will discuss the situation in terms of turnover and

flexible work scheduling. With this background, managerial considerations for dealing with the problem of balancing work with life are offered.

Background

The Nature of the Work

Most paid providers of long-term health care are paraprofessional workers, who work many high stress hours for low wages. After informal caregivers, these workers are the most essential component in helping older persons and younger people with disabilities maintain some level of function and their quality of life.

Many of the tasks for these long-term health care workers are physically and mentally demanding, including:

- Answering patient call signals
- Turning and repositioning bedridden patients in order to prevent bedsores
- Observing patient conditions, measuring and recording food and liquid intake, output, and vital signs, and reporting changes to other professional staff
- Feeding patients who are unable to feed themselves
- Providing patients with help walking, exercising, and moving in and out of bed
- Providing patient care by supplying and emptying bed pans, applying dressings and supervising exercise routines
- Bathing, grooming, shaving, dressing, or draping patients to prepare them for surgery, treatment, or examination

The number of health care jobs has been increasing since the 1950s, more than in any other comparable industry group, because of the aging population, new technologies, and greater administrative requirements (Berger, 2009). Healthcare

facilities strive to provide greater services in less costly ways. Nurse practitioners have increased in number as the healthcare industry encourages their use for functions previously performed by doctors. While some states have increased nurse practitioners' authority, the stress surrounded by the job has also increased leading to more employee turnover (McCoy, 2009).

Even though many of the positions in health care have inflexible schedules, the healthcare industry has grown by more than double the economy's growth rate. Only an approximate eighteen percent of workers in the health care industry are given flexibility in establishing their schedules according to the specific needs of the organization and the employees concerned (McCoy, 2009). The health care industry, in comparison must account for all days of the calendar year. Their clients need twenty-four hour, three hundred sixty five day care so health care managers must account for staff working every day, every hour of the year and have enough staff to adequately take care of every client during slow and unpredictably busy times. Like informal caregivers, the overwhelming majority of frontline long-term care workers are women, who typically take the more active role on the home front than men. While these workers are engaged in physically and emotionally demanding work, they are among the lowest paid in the service industry, making little more than the minimum wage. Nationally, slightly under fifty percent of CNAs are white, while the other fifty percent are Black (37%) and Hispanic (15%) (Probst, Baek, & Laditka, 2010).

Employee Turnover

The health care industry provides an inflexible scheduling model for managers, thus leading to a higher employee turnover rate for those trying to balance work and

family responsibilities. The average turnover rate for workers in nursing homes is about 50% nationally and depends on the region of the country (Ramde, 2009). High rates of staff vacancies and turnover have negative effects on health care providers, consumers, and workers. The cost for providers to replace workers is high; quality of care may suffer; and workers in understaffed environments may suffer higher rates of injury (Stone & Wiener, 2001). Managers must schedule workers so there is enough adequate 'coverage' to lower the amount of risk in the facility at any given time while concentrating on the costs involved. Lastly, managers must try to satisfy the desires of their workers to ultimately keep them happy and productive.

Survey data gathered at 45 care facilities from 398 health professionals (Thomas & Ganster, 1995) suggested that supportive practices, especially flexible scheduling and supportive supervisors, had direct positive effects on employee perceptions of control over work and family matters. In turn, dissatisfaction and depression about the job had direct negative effects on control perceptions over work and family matter, leading to lower levels of work. If organizations take steps to help employees manage the conflicting demands of their work and improve work attitudes, then those employees become more able to control their family responsibilities. Results reveal a positive association between work schedule flexibility, employee performance, and absenteeism, but no significant relationship with job satisfaction (Thomas & Ganster, 1995).

Company policies must be feasible from the employees' standpoint, and must be relevant towards the organization's overall goals. The lack of relevance in company policy to employees may cause resentment, resistance, and loss of worker self-esteem. Banaszak-Holl and Hines (1996) studied factors affecting nursing assistants' turnover in

254 facilities in metropolitan areas in ten states. The strongest effect on turnover rates for employees among facility characteristics was the concept of ownership status. One of the study's most important findings was that facilities in which nursing supervisors accepted nursing assistant's advice or simply discussed care plans with the aides reported turnover rates that were one-third lower than those without these practices (Banaszak-Holl & Hines, 1996).

Employee turnover can negatively impact the quality and continuity of patient care. Turnover can also lower work unit morale, strain worker relationships, and increase the patient risk. To help address potential turnover problems, employers are using the lure of cash and prizes to retain employees (Ramde, 2009). With an economy riddled with job cuts in nearly every industry, applicants for nursing jobs (especially in long-term care) are still scarce and as a result, recruiters in some markets have been forced to become increasingly innovative. Recruiters have been faced with the long-standing U.S. nursing shortage that has led to chronic understaffing and threatened patient care as well as employee job satisfaction. Industry experts point to the operating shortage since World War II being on an eight-to-ten-year cycle. When the number of nurses reaches a critical low, the government adds funding and hospitals upgrade working conditions. As the deficit eases, those retention efforts fade and eventually the old conditions return, often driving nurses and nursing assistants into other professions (Nelson, 2002). Another issue is that "wages haven't kept up with the level of responsibility and accountability", according to Cheryl Peterson, the director of nursing practice and policy for the American Nurses Association. For future managers in the field of long-term care another director also recommends, "you need to get people

excited about what you're offering...if you don't, they (qualified nursing staff) can easily go elsewhere." (Peterson, 2001).

Better Jobs Better Care is a four-year, \$15.5-million research and demonstration program funded by the Robert Wood Johnson Foundation and the Atlantic Philanthropies. Five state demonstration projects (Iowa, North Carolina, Oregon, Pennsylvania & Vermont) and eight research grantees used different paths to study and test what could help reduce direct care worker turnover and build a quality and committed workforce (Livingston, 2008)..

According to *Better Jobs Better Care*, the following is a list of the different costs associated with frontline turnover:

Frontline Turnover Cost Accounting

Provider Enterprise Costs – Direct Costs:

- Separation
- Vacancy
- Replacement
- Training & orientation
- Increased worker injuries

Provider Enterprise Costs – Indirect Costs:

- Lost productivity until replacement trained
- Reduced service quality
- Lost client revenues and/or reimbursement.
- Lost clients (existing & potential) to other agencies due to deterioration in agency image, etc.

- Deterioration in organizational culture and employee morale adversely impacting reputation, service quality, and further increasing turnover.

Costs at Service Delivery Level – Consumer/Clients:

- Reduction in quality of care and quality of life
- Care hours not provided

Costs at Service Delivery Level – Workers:

- Increased worker injuries
- Increased physical and emotional stress
- Deterioration in working conditions leading to increased likelihood to quit

Third-Party Payer Costs:

- Underfunding of care services due to financial drain of turnover
- Increased downstream medical costs for Medicaid and Medicare due to illnesses and injuries attributable to reduced service quality
- Higher levels of institutionalization of clients due to insufficient community-based staffing & quality of care

Source: The Cost of Frontline Turnover in Long-Term Care. (Seavey, 2004).

The Use of Flextime

There are three generally accepted forms of flextime implemented by employers: the gliding schedule, which allows workers to vary arrival and departure times; variable schedules, which require a specified number of working hours without set schedules; and compensatory time arrangements, which allow employees to apply overtime to future time off. Most employers in the health services industry implement compensatory time because of the needs of the facility to have adequate staff 'on duty' to take care of

clients. Some managers will involve their employees in the decision-making process in regards to changing the starting and quitting times periodically in order to find a schedule acceptable for the employees' needs. Giving a voice in the company's decision-making process may strengthen employer-employee relations (Berglas, 2009). Also, employees are able to schedule work more in tune with their own "functional clocks", that is, they can choose to work during those hours when their skill and response levels are most productive. Benefits to the employer include reduced hours of overtime to 'cover' employees who are late, absent or quit because they do not "like the schedule". Natural concerns with flextime and allowing employees to pick work hours are: difficulty in scheduling meetings with employees, not having key employees available when needed, and employee abuse of flextime used (Hardy, 2009).

Compressed workweeks are another alternative arrangement used for hours worked in the health services industry. Basically, the total hours in compressed systems are held constant, with employees simply working more hours in each full day and fewer days per week or fewer days during a biweekly pay period. The most popular schedule is for workers to be 'on duty' four - ten hour days. This arrangement allows some overlap of hours during peak times as needed by management. Other facilities have proposed the schedule of three twelve hour days (only 36 hours; some states require the payment of overtime compensation for hours worked in excess of eight hours on any given work day). Other scheduling options to account 'coverage' for each day are as follows:

- Four On, Four Off arrangement: Employees work four days or nights and then have four days or nights off. Workers' days off move one day forward each

- week, so there is no consistency in scheduling. One drawback to this arrangement is that workers may “grow tired” of working by the fourth day in a row because of the demanding physical and mental nature of the work involved.
- The 2-2-3 arrangement: Otherwise known as “Every other weekend off”. Fourteen day pattern of two-days-on, two-days-off, three-days-on, two-days-off, two-days-on, three-days-off. There is some consistency because workers know they will have a three day weekend every other week and will not be required to work more than three shifts in a row. One drawback for managers: If workers schedule flextime (or PTO – paid time off), then the remaining staff may be asked to work extra time to supply ample ‘coverage’ for a shift (or multiple shifts).
 - The DuPont arrangement (after the company where it originated): Seven or eight straight days off during every twenty-eight-day rotation. Usually there is a maximum four-day or four-night stretch of work and a short twenty-four hour break between three day shifts and three night shifts. One feature of this arrangement is that the employees get a “mini vacation” every month. A major drawback is that managers have limited options when requesting extra time from employees to provide needed ‘coverage’. In addition, workers may become fatigued during the working stretch which is not good in the health service industry because of the potential for employee errors.

Flexible work arrangements are often embraced by employees because of the longer periods of personal time allowed. Also, being involved in making decisions on

scheduling can be empowering to the employees. Despite these advantages, two disadvantages can occur in health care settings. First, workers can become more fatigued especially during long stretches of work time. Second, workers can become “out of the loop” with so much time away from the facility concerning the patients’ immediate needs.

In more competitive situations with scheduling at a facility, scheduling software is available to managers in some long-term health care facilities. One example is Lawson’s software that allows nurses to see and bid on open shifts using eBay. Depending on access from a supervisor, employees can be given a “buy it now” option to confirm open shifts and can be given the chance to apply for slots through a pay-based bidding process. Managers control the internet-based interface and allow users to see only shifts for which they are qualified to work (Rafter, 2008).

Many potential candidates for work in the long-term health care industry are in training at this time to hopefully fill the staffing voids in the nursing industry. The American Association of Colleges of Nursing reported in its 29th annual survey of nursing colleges that the enrollment in baccalaureate nursing programs increased by a projected 3.5% in 2009, reversing a five-year trend in declining growth rates. The growth rate in 2009 was 2.2%. The survey also reported that the number of new graduates from baccalaureate nursing programs increased by 3.2% in 2009 (Carlson, 2009). Even with this increase at the college level, according to the Institute of Medicine, the supply of the healthcare workforce in the U.S. will fall 29% below projected requirements without any other changes.

Managerial Considerations

Managers in the long-term health care industry need to always look at the “bottom line” because in the overall scheme, the facility needs to generate a sufficient amount of revenue to continue to operate. With more people out of work due to the recession, long-term health care is not affordable to some and those out of work family members are becoming caregivers to those family members in need of long-term care. When long-term care facilities are not filled to capacity, then managers must make tough staffing decisions. After several years of growth in the industry, health care facility revenues were expected to decline 23 percent in 2009, according to Staffing Industry Analysts (Carlson, 2009). When these low revenue numbers are revealed, the overall expenses of each facility including staffing will continue to be thoroughly scrutinized by managers. In spite of these declining numbers, the health care industry does continue to add jobs in the recession – just not nearly as many as in the past (Carlson, 2009).

For managers at long-term care facilities, there has been a grass-roots movement of “culture change” in the U.S. for about 15 years (Commonwealth Fund, 2008) that has identified three challenges: securing adequate financing, improving the quality of care in long-term facilities and developing a workforce that is sufficient in both size and skill to provide care. This “culture change” not only addresses quality and workforce issues, but it can also improve occupancy rates, operational costs and competitive position in the marketplace – all of which can improve a facility’s bottom line (Zigmond, 2009). Managers will need to act as leaders in the redesign of the job in order to retain health professionals. Since we know that many health professionals suffer from “burn-out” and frustration and switch occupations, an important long-range goal should be to make the

healthcare work environment more attractive compared to other settings. This might be accomplished in several ways by adopting nurse-friendly practices such as prohibition of mandatory overtime (to reduce fatigue) and providing minimum staffing ratios (to have sufficient staffing at all times). Recommended CNA/patient ratios are usually 8 patients to one CNA but many facilities operate dangerously at ten to one ratios, fifteen to one ratios, and even twenty to one ratios depending on the economic stability/cost cutting “culture” of the facility (Hegeman, 2005).

Also, to help with this “culture change”, a bipartisan group of U.S. senators and congressmen introduced legislation in January 2009 to offer more educational and training opportunities for healthcare workers in long-term care and gerontology. The Retooling the Health Care Workforce for an Aging America Act would amend the Public Health Service Act, the Workforce Investment Act, the Older Americans Act, and the Social Security Act. (Probst, Baek, & Laditka, 2010). The aim of the legislation is to expand skill sets and knowledge among licensed health care professionals, direct care workers and family caregivers. Many see that without this “culture change” and ‘retooling’ the skills of the health care workforce, the supply of the health care workforce in the U.S. will fall even more than the 29% projected decrease. The end result may be replacing these workers with less experienced and less dedicated workers in the health care workforce.

Effective leaders have a genuine desire to empower the people they lead and identify the talents of subordinates to help build them through proper training into workable strengths and competencies (Wheatley, 2006). Workers can thus become satisfied with their work situations and know that their supervisor has their best interest.

Individuals may or may not require more in regards to salary, working conditions or their relationship with their supervisor(s) depending on their economic or emotional status. If there is not a good relationship with supervision, workers could become more and more dissatisfied with their work over time. Individuals are motivated to perform because of the expectations and perceived rewards that come from their work. Management must make sure through clear expectations that those perceived rewards become actual rewards (Dent, 2005). Managers can even be effective in the employee's process of goal setting. Employees need to know what they want to achieve within the organization and know where they would also want to concentrate their efforts.

An essential element in the interpersonal communication process can be feedback from subordinate employees as a self-correcting mechanism to management to implement alternative work scheduling and company policy efficiently. But conflicts about work scheduling between employees and management may even occur especially if managers are more interested in saving their own jobs than those of their employees especially if there are layoffs. Employees with valuable passion for the organization having a say in decisions made in an organizational transition are desired but managers must keep the focus of facility staffing on the overall organizational goals.

Workforce Optimization

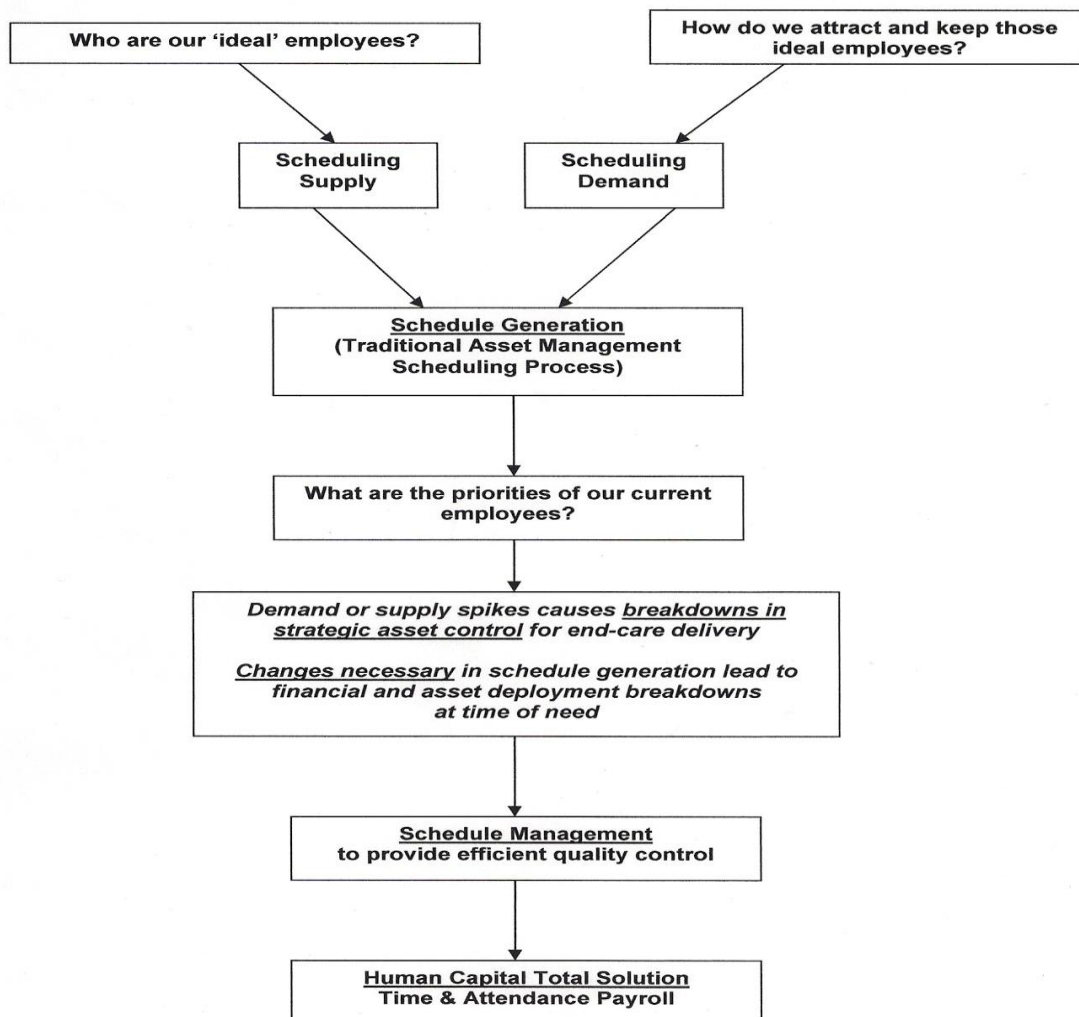
Workforce scheduling by management is the process of assigning the right employees with the right skills to the right job at the right time. It is not simply managing the administration of past and future working times, it also includes the forecasting of the workload and required staff, the integration of employees into the scheduling process depending on their abilities, and the analysis and monitoring of the entire process as one

cohesive unit. All aspects of managing the complete workforce lifecycle and support for the key business processes for the facility are now evolving into a solution termed workforce optimization. The role of workforce optimization is to tie together separate systems and bridge the three main operations of human resources, operations and information technology. Workforce optimization is viewed as a logical step in the move to optimize the performance and impact of staff on both operational efficiency and customer experience.

Health care managers must realize the importance of workforce optimization and its ability to directly or indirectly affect frontline cost accounting through turnover. With workforce optimization, managers should be able to provide numerous benefits to employees including more effective and enhanced training. In a study collected as part of the *Better Jobs Better Care (BJBC)* project about job perceptions and intent to leave (Livingston, 2008), the following key findings were noted:

- 66% of workers stated that commitment to consumers was the top motivation for taking their jobs. Flexibility (or perceived flexibility from supervisors) was the second most important reason for taking their jobs.
- A 30% decrease in intention to leave the job was associated with increased supervisor quality. In terms of job rewards, the most highly ranked reward was helping others, while income was ranked as the lowest reward. Lack of self-actualization (perceiving one's job is a "dead end" job) and overload were the strongest associations with intention to leave.
- Ability to change one's schedule or have input in their schedules (job reward).

Workers are easily annoyed when managers consistently schedule “useless” floating staff during less than peak times and do not have enough staff during busy, peak times as support. The workplace nowadays, needs to utilize finely honed, flexible, staffing and scheduling systems proven to reduce turnover by increasing job satisfaction. Health facilities will be able to have a competitive advantage without sacrificing quality by properly finding a balance between financial/operational proficiency and safety required staffing needs. The following is the proposed Healthcare Human Capital Total Solution – through the value chain (Green, 2008):



Source: adapted from Green, 2008.

Managers need to remember the effective yield including items that do not show up on expense lines: the cost of personnel turnover and the potential expense/risk of performing a function poorly. To determine yield, a manager must ask these three questions: What are the priorities of our current employees? Who are our 'ideal' employees? How do we attract and keep those ideal employees? These "soft" issues can translate into hard costs and savings, and can affect how a manager deals with valued employees.

When managers do not properly staff facilities, and still demand excellent customer service from those overworked employees, respect for management is lost because there is a perception that management does not care if those employees are overworked.

Concluding Comments

Increasingly, employers in the health care industry are becoming more sensitive to their employees' need for a fair balance between work and their personal lives. If employers are not empathetic to their employees' needs and do not supply adequate staffing support during peak times, workers will become frustrated and may seek other employment within the industry or elsewhere. Implementing flexible work scheduling programs will succeed only if management supports them. Such programs can result in fewer sick days, less absenteeism, and even lower healthcare costs. A content workforce gives management less to worry about with regard to retention and consequently recruitment. Direct care workers should not be required to consistently work overtime hours – a situation that increases a worker's chance of injury and patient errors. Instead, changes in staffing should be met so that unreasonable demands are not consistently placed on individual workers.

Many times, managers try to provide decisions in scheduling to appease the consensus of their workers while ignoring the organizational focus. When a group of managers moves away from the organizational focus and is centered towards a different decision of consensus, any unpopular or minority views are disagreed with and eliminated even if it is the correct view in regards to the organizational focus. This role conflict, due to an agency problem, puts subordinate employees in a contrasting position where their personal views are different from the managing group. Worker resistance, in these situations, should be analyzed as a natural reaction to poor management decision making, and not always assumed to be inappropriate (Dent & Powley, 2002). Work scheduling impacts employees' lives in many ways and should be taken seriously by management. The supervisor's tone, word choice and body language are critical in times where a nurse's aide may be experiencing problems at home. Low CNA retention rates are often the result of management practices that seem to devalue direct care work and create a sense of disrespect.

According to psychologist Irving Janis, group dysfunction may lead to, "a deterioration of mental efficiency, reality testing, and moral judgment that results from in group pressures" (Luthans, 2008). The most common dysfunction associated with groups and teams is social loafing (unproductive activity on the part of one or more group members). Ineffective managers may ask productive employees to work more to cover for the reduced effort given by social loafers, often without any added incentives. This practice can lead to more dissatisfaction at the workplace from the most productive employees.

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A Comparison of Two WYSIWYG Software Packages

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Abstract

WYSIWYG software packages can be very useful tools available to aid in the creation of a website. WYSIWYG is an acronym for “What you see is what you get.” Budget conscious individuals and companies could benefit from the use of this software. It enables everyday users to create their web pages using familiar toolbars and also take advantage of drag and drop features. WYSIWYG software allows users to view the outcome of their page as they create it. KompoZer and Amaya are two WYSIWYG software packages that are available. A comparison of the two shows that while they offer many of the same features, they are very different in style and setup. The author intends to convince readers of the superiority of KompoZer over Amaya.

A Comparison of Two WYSIWYG Software Packages

Companies are turning to technology to help lower costs, increase efficiency and improve effectiveness. The Internet has opened many outlets for businesses. One outlet is a website. Websites can be a valuable resource. They help companies advertise their products, give customers information, and provide a communication link between the company and the customer. Unfortunately, creating and maintaining a website can be a very expensive venture. Many companies shy away from using websites due to the high cost of software and technical skills. However, due to the growing market of open source and free software, these companies may be able to expand their companies to the internet.

WYSIWYG

WYSIWYG is an acronym for “What you see is what you get.” This acronym can describe a type of web development software. WYSIWYG allows users to view the product of their website as they build it. In our fast-paced society, where additional funds are scarce, this type of software is becoming very useful for companies.

The interactive editors provided by WYSIWYG software eliminate the need for a highly skilled web developer. This software allows users to use familiar menu bars and tools to create their websites. Drag and drop features make adding pictures, links, and navigation menus very easy. These features give the everyday user a chance to show case his or her web design abilities.

There are many different types of WYSIWYG packages. Each one is equipped with a different set of tools to use. Some offer a very light version of the editor. These WYSIWYG editors are for a more experienced developer. Users place a line of code within the HTML, and an interactive editor will appear within the browser. This type of editor would be useful for quick updates on an existing page.

Other WYSIWYG software packages offer a heavier version of the editor. This type would be good for users wanting to build a simple static website. After familiarizing themselves with the software, they could completely build their site from start to finish. With this type of editor, users never see the code itself. The website can be constructed entirely by simple drag and drop features. This would be the best type of software for small companies and budget conscious organizations. Thanks to open source, many of these editors are offered free of cost. KompoZer and Amaya are both types of WYSIWYG packages.

Compared to the other packages available to download, KompoZer and Amaya offer considerably more features. These two packages are more complete. The developers of these packages are offering updates and looking for bugs in the software. Because the developers are still working with the packages, a considerable amount of online support is available for users to use. Forums and informational sites are accessible to help users troubleshoot. However, due to the nature of technology, it is possible for support for WYSIWYG packages to diminish because developers will move to new projects.

KompoZer

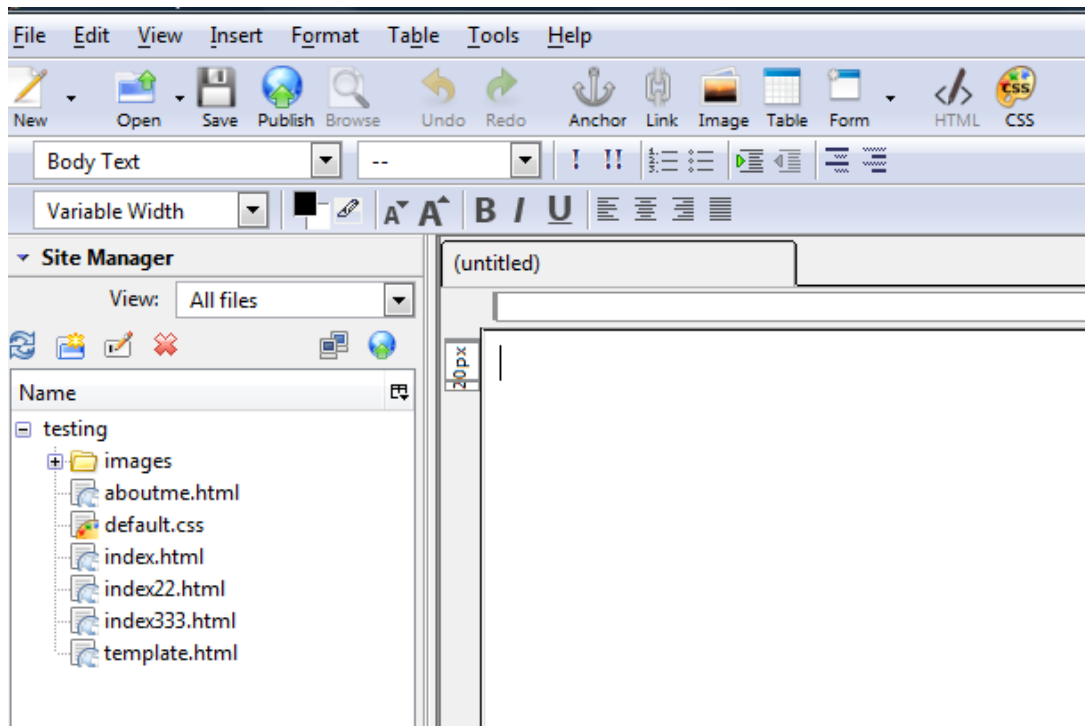
KompoZer is a WYSIWYG software package available for use. It is open source, which means it is completely free. Users can download the software directly from KompoZer's website at <http://kompozer.net/>. Downloading KompoZer is very simple. It has its own setup executable that does all the work for you. KompoZer opens by selecting an icon from the start menu or desktop. KompoZer is a very user-friendly application. It offers many helpful tools that can aid in building a basic website.

When you begin creating your website, KompoZer will put all the opening and closing tags in for you. All of your pages and folders within your site display in the window on the left. This makes it easy for users to keep track of their pages and images. KompoZer loads templates and previously created sites with ease.

Formatting Features

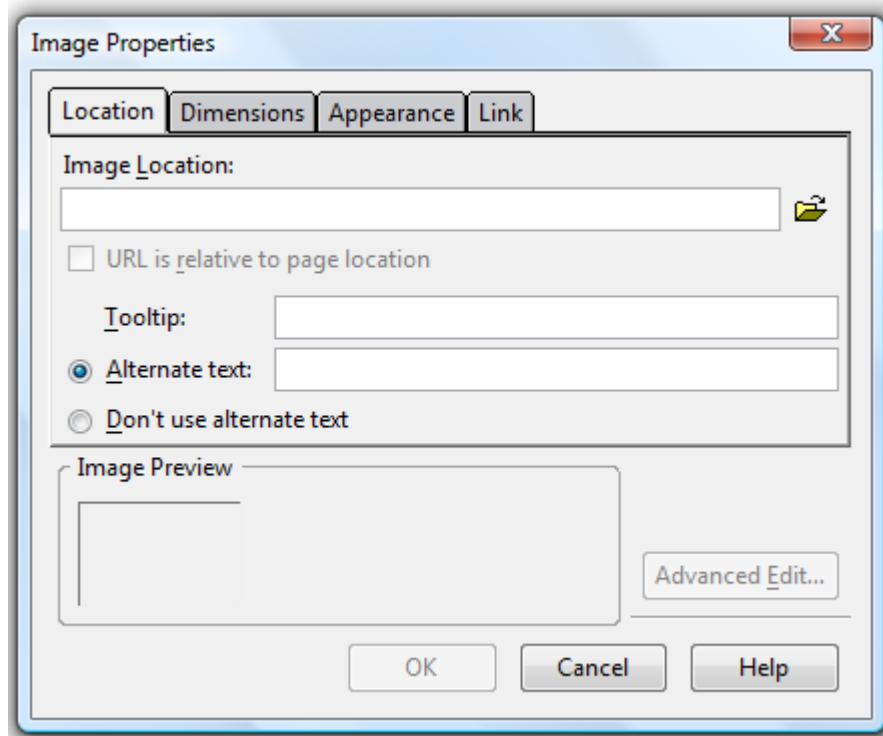
KompoZer makes it very easy for users to format their pages. Text font, color and alignment buttons are accessible from the toolbar at the top. Users can also change the color of the background or add images to act as the backdrop for the page. KompoZer

supports cascading style sheets (CSS) to help users with formatting. Users can specify classes so they will not have to format each section individually.



KompoZer Menu Bar and File List for Website

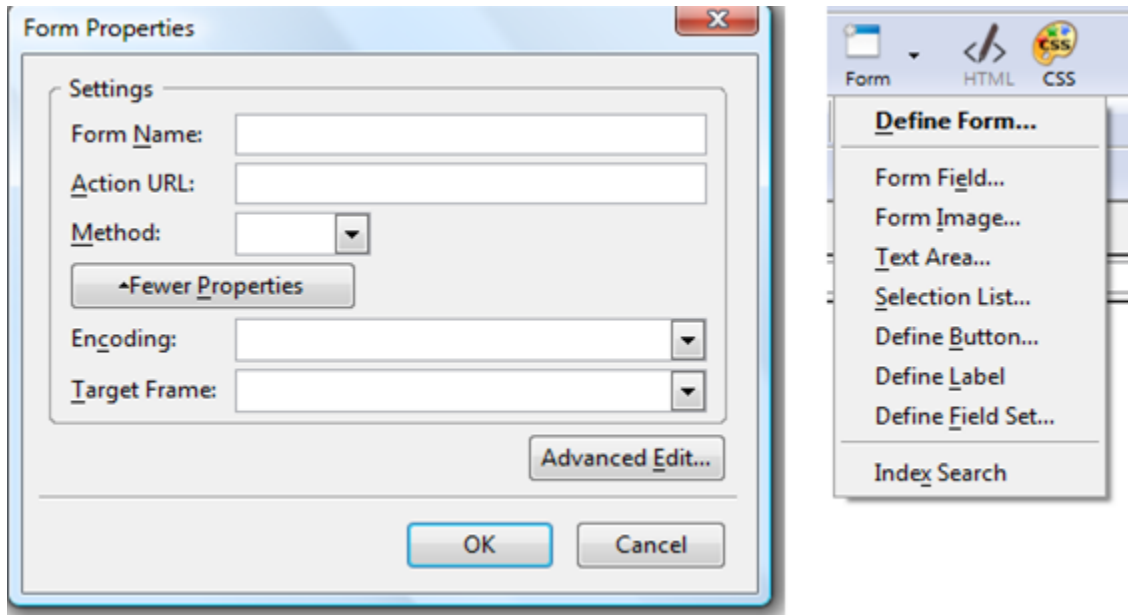
Users simply locate the image icon and a pop up appears to allow the user to select an image. From this screen, users may also enter alternate text, change the size, and set the spacing and alignment of their image. Once images are on the page, users may resize and drag the pictures around the page as they see fit.



KompoZer Insert Image Screen

Adding navigation tools such as links and menu bars are very easy with KompoZer. Users simply select the text that they want to act as the link to another page, and click the menu icon for links. A pop up will allow users to enter in the page that they want the link to connect to. This pop up also asks users if they want to open the connection in a new tab, in the current tab, or even a new window. KompoZer even asks if the link is an email address so that it will know to open the user's email client.

If users would like to add areas for their viewers to interact with, KompoZer has the ability to handle forms. Users can select forms from the tool bar and design their form with textboxes, buttons, and selection lists. This could be useful for simple surveys or comment boxes for websites.

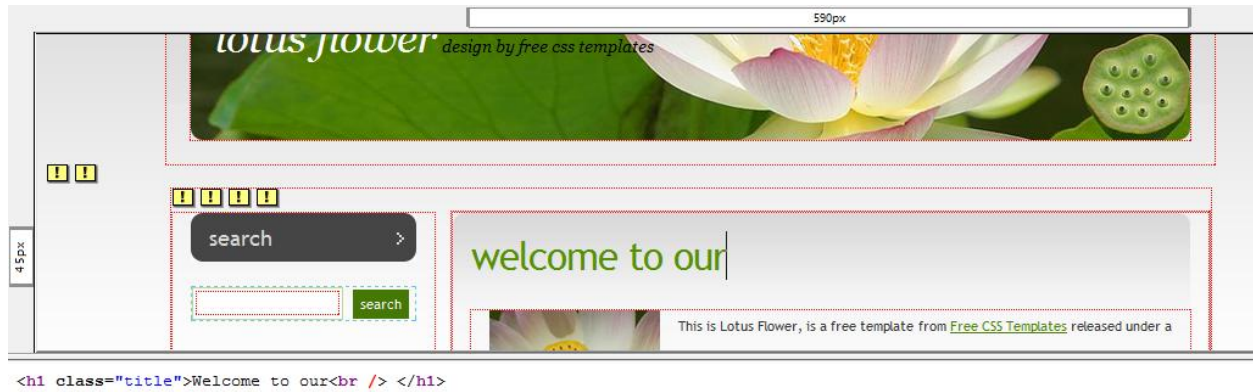


KompoZer Form Screens

Editing, Viewing, and Publishing

KompoZer offers some editing features for users to use. They offer a real time spell check option. This option is very useful for users entering in large amount of information initially to their page. A simple typo can damage a company's image. It is very important to ensure that the information is accurate on the site.

KompoZer makes editing websites very easy. For simple edits and updates, users can type directly into the editor screen. Advanced users can also view the code portion of the website if they feel more comfortable editing from the back end. To change a picture on the webpage, users simply click on the image button and the insert image screen will appear. Numbered lists, bulleted lists, font type, font size, bold and italic effects, and text alignment are available to help users edit their webpage.



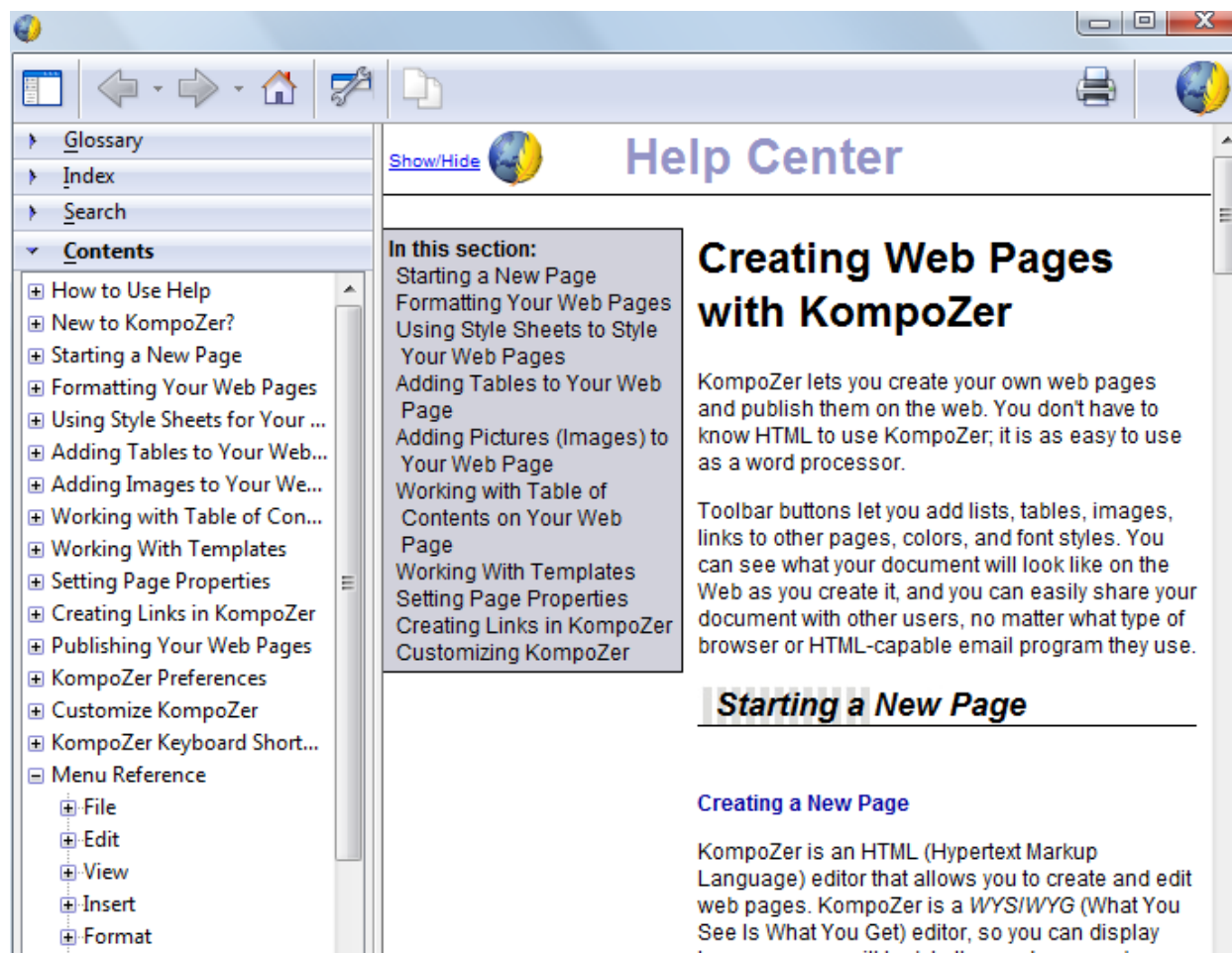
Editing with KompoZer, in the Editor or in the Code View

Although users can count on their site looking like the screen they develop in the editor, KompoZer offers an option for users view their website in an actual browser. The webpage will open in the browser the user has set as the default. After they open the site in the browser, users are able to test their links and view how the site looks in real time.

KompoZer has a built in file transfer service that is suppose to allow users to transfer their files over to the server. This service did not seem to function very well. Users would be better suited to try a free FTP program over KompoZer's FTP service.

KompoZer's Help Menu

KompoZer's top menu bar provides a menu for "Help". This menu is a very useful resource for users. It provides links to a glossary where users can look unfamiliar terms, links to forums, tips, and KompoZer support online. The "Help" menu option "Help Contents" brings up a display box that holds the glossary, index, a search screen, and all of the contents present within the Help tool. The fact that users can search for specific problems makes this help menu very efficient.



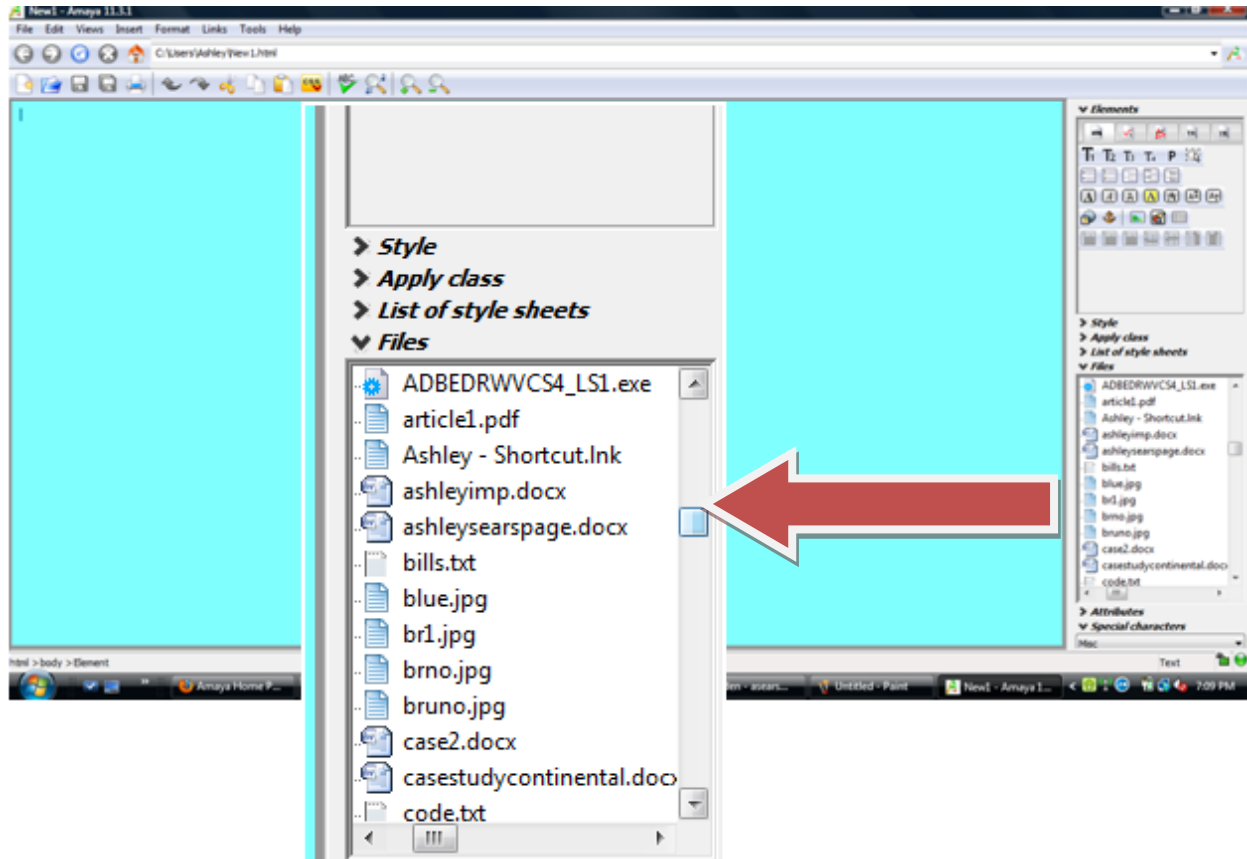
Kompozer's Help Screen

Amaya

Amaya is another open source WYSIWYG software package. Users can download it easily from their website at <http://www.w3.org/Amaya/>. Amaya opens with an icon on the desktop or start menu. Although it offers many of the same features, Amaya does not seem to be as user friendly as KompoZer. It also runs slower. Amaya lags between selections of different options; this can become very frustrating.

One of the major downfalls of Amaya is the layout of the menus and toolbars. All of the menus stack on top of each other, and users have to collapse each to view the next

level of options. This becomes very annoying because many of the tools you need are spread across many different menus. One of the menus displays all of the folders on your computer that are available to add to your site; however, there is not a window displaying all of the pages that are in just your site.



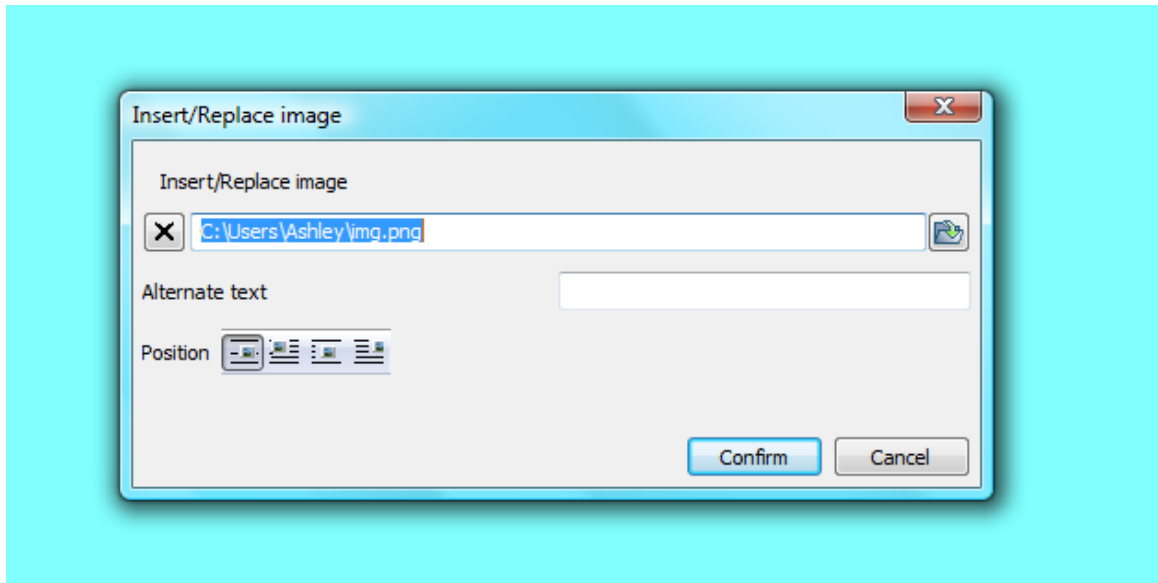
Amaya Screen Shot- Menu and File List

Formatting Features

Amaya has many of the same formatting features that KompoZer offers. The features that create text, text color, size, and alignment are all available. They are all located on the right hand menus.

Users can insert images from a menu button on the right side of the screen. However, unlike KompoZer, there is not an easy way to set the size and alignment from

the pop up insertion screen. The handles on the edge of the picture are the only way to adjust the size. You can drag the image to where you would like it to be, but the horizontal and vertical spacing is not easily set.



Amaya Insert Image Screen

Amaya does have the capability to add links easily to a page. However, to specify where to open the link you have to navigate to another menu option. In KompoZer, all of the options are available in just one screen.

One advantage that Amaya has over KompoZer is its ability to insert shapes on to your page. Amaya has a menu of common graphics such as squares, lines, and circles. This could be useful for businesses that need to put many diagrams on their site for viewers.

Amaya has a menu item for forms; however, it was not nearly as easy to use as KompoZer. After several attempts to see it on the page, Amaya eventually just froze.

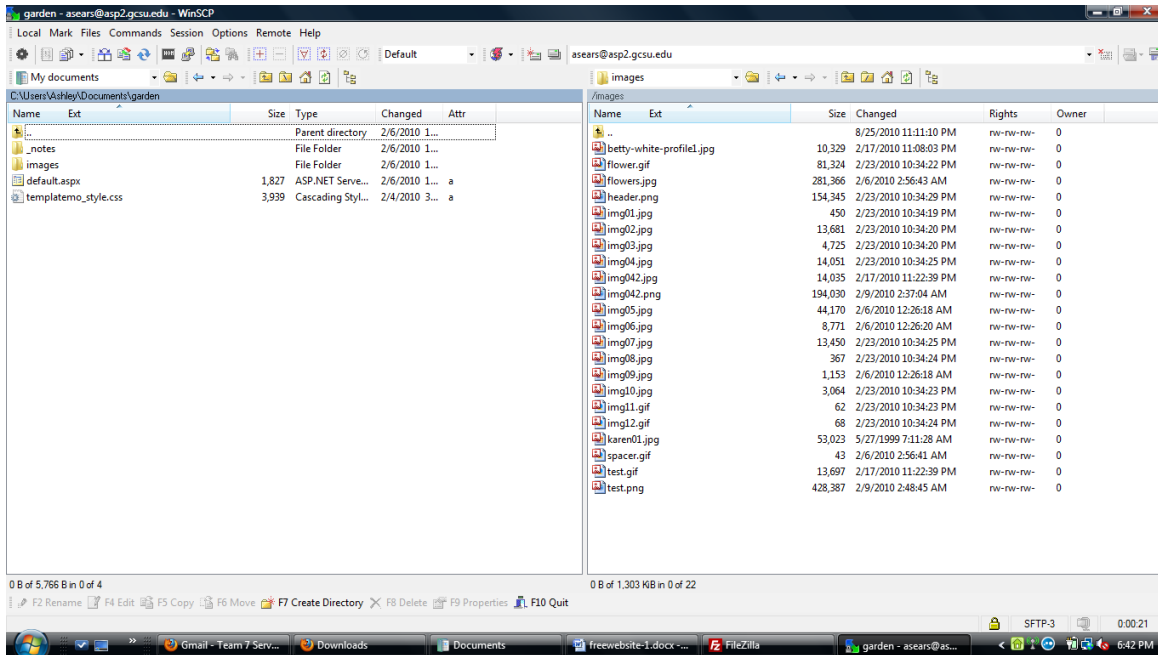
This function may be something the Amaya developers are currently adding to the software.

Editing, Viewing, and Publishing

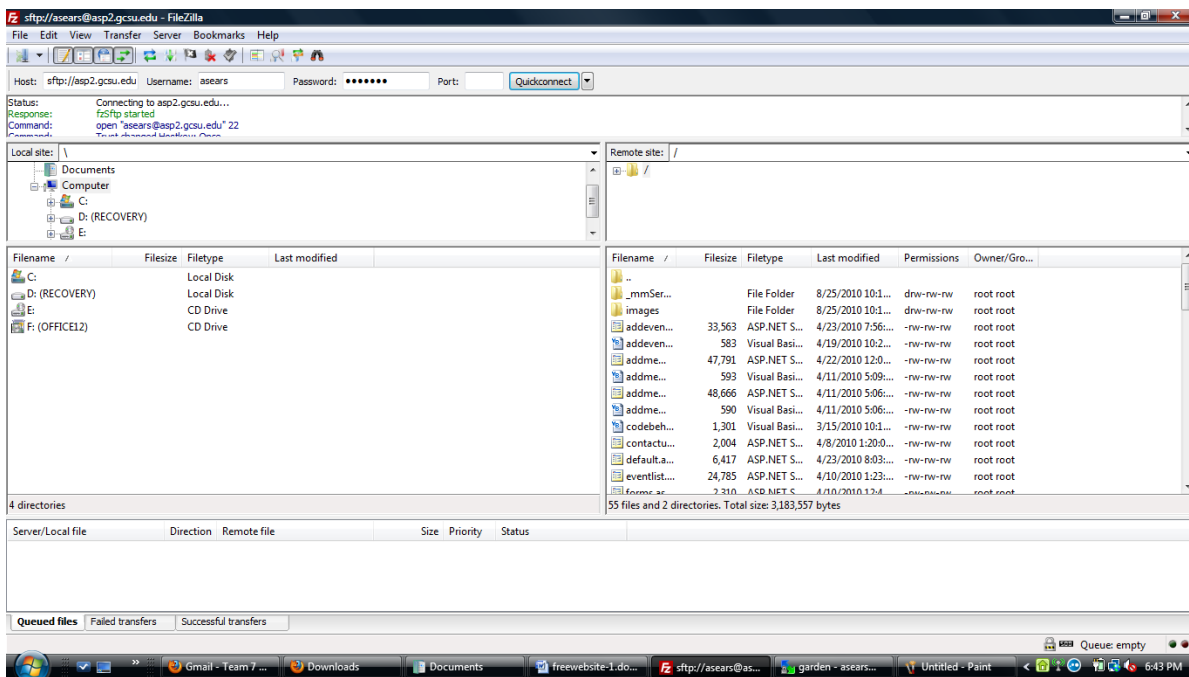
Amaya offers a spell check function like KompoZer. However, it is not real time. Users will have to select the option from the menu bar in order for the software to check for mistakes.

The software package also enables users to view their webpage in a browser. This is comparable to KompoZer's viewing ability. Users can test their links and menus in this view.

Amaya does not have a built in FTP service. This means users will have to transfer their files with an outside application. Many FTP services are available for download on the internet. Two popular FTP services are WinSCP and FileZilla. They are available for download at <http://winscp.net/eng/index.php> and <http://filezilla-project.org/> respectively. Both are very easy to use. They ask users for the host name, username, and password to login to their server space. Both show the files currently on the server and the files on users' computers available to transfer.



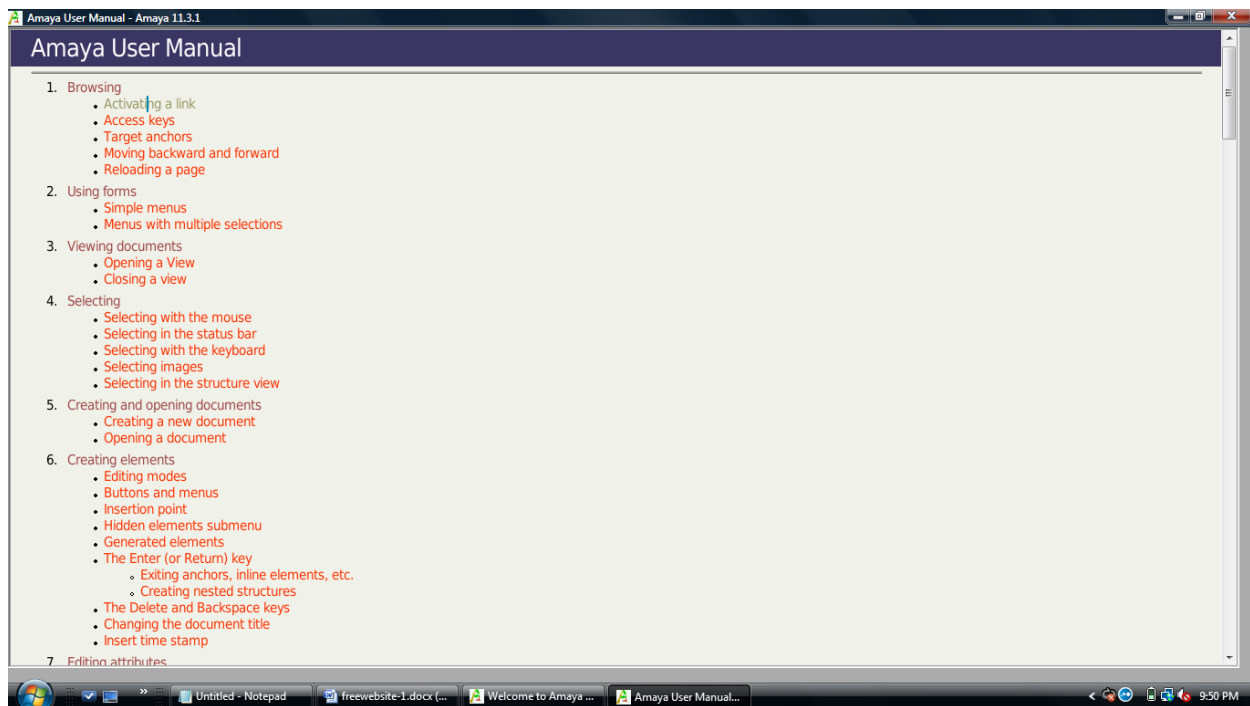
Screen Shot of WinSCP FTP Service



Screen Shot of FileZilla FTP Service

Amaya's Help Menu

Amaya has a help menu present on the menu bar. This help menu leads users to a submenu titled "Amaya Help". This menu option has a variety of helpful topics for users. It gives an outline of all of the tools that Amaya offers. This would be very helpful for users. The menu includes a brief definition on each tool and how a user can use it on their website. Unfortunately, the contents of Amaya's Help menus do not include search functions. This means that users have to go through all of the information presented to find what one topic they are looking for.



Amaya Help Menu

Conclusion

WYSIWYG software packages are useful tools for budget conscious companies looking to develop a website. They cut out the need for a skilled programmer. The

features they offer enable any user to sit down and create a basic a page. Websites are becoming a mainstream way to get information about your company to the public.

KompoZer and Amaya are both types of WYSIWYG software packages.

KompoZer seems to be user- friendly and offers more powerful menu options.

KompoZer would be a great choice for anyone to use to create his or her first page or maintain an existing static site.

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Perceptions of Constraint and Resource in the Construction Industry: An Investigation

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Introduction

The purpose of this paper is to attempt to assess the identification of constraints and resources within two separate organizations. By way of an electronic survey, employees will be questioned about certain aspects of their organizations and their perceptions about whether or not they consider these aspects to be resources for the company or constraints. This paper will then derive an explanation of what constitutes a constraint and a resource within an organization.

As an introduction to this topic the classical definitions of constraint and resource will be given from both a general usage and management theory perspective. A survey administered to individuals in the construction industry will measure perceptions of various components as constraints or resources.

Literature Review

Merriam-Webster gives a number of different definitions of resource, including: a source of supply or support; a natural source of wealth or revenue; a natural feature or phenomenon that enhances the quality of human life; computable wealth; and a source of information or expertise (Merriam-Webster 2010). The same holds true for the Merriam-Webster definitions of constraint, which include: the act of constraining; the state of being checked, restricted, or compelled to avoid or perform some action; a constraining condition, agency, or force; and repression of one's own feelings, behaviors, or actions (Merriam-Webster 2010). For the purpose of this research, a more concise definition of constraint and resource will be given. These definitions come from a production/operations research perspective.

"According to the resource-based view of the firm, the definition of a resource can include all assets, firm attributes, organizational processes, information, and knowledge controlled by a firm that enable it to design and implement strategies effectively and efficiently" (Berry-Stölzle & Altuntas, 2010). The resource-based view of the firm has become one of the most widely accepted theoretical perspectives in strategic management and its theory views resources as the cornerstone of competitive advantage and firm performance (Spyropoulou, et al., 2010). A firm's resources are evaluated by how valuable, rare, and hard to duplicate they are for the firm's competitors. There are three types of resources that firms can possess: tangible resources, intangible resources, and organizational capabilities. Tangible resources can be financial, such as a firm's cash account and cash equivalents; physical, such as favorable manufacturing locations; technological, such as innovative production

processes; or organizational, such as effective strategic planning processes. Intangible resources can be human based, such as the experience and capabilities of employees; innovation and creativity based, such as the firm's technical and scientific skills; or reputation based, such as the firm's reputation with customers for quality and reliability. Organizational capabilities include the firm's competencies or skills the firm employs to transfer inputs to outputs.

A constraint is something that puts some limitation on a resource and restricts the full utilization of that resource. In his book, "The Goal: A Process of Ongoing Improvement", Eliyahu M. Goldratt developed his Theory of Constraints which is defined as "a management philosophy that provides a focus for continuous improvement resulting in improved organizational performance (Inman, R., et al., 2009)." According to the Theory of Constraints, a constraint on a resource is the part of processing that is blocked or bottlenecked (Goldratt, 1992). TOC focuses on "the resource with the lowest capacity (or the "bottleneck") which constrains the number of units that a firm can produce at anytime" (Sridharan, 2009) "the weakest link in the chain" (Kohli & Gupta, 2010).

This research will look at and compare the results of two different firms in the construction industry. One firm will be non-profit and the other firm will be for-profit. The survey will be distributed to multiple levels of employees throughout these two companies.

Research Question and Methods

The purpose of this research is to determine the differentiation between the perceptions of constraints and resources by for profit and non-profit organizations. Information will be gathered using an electronic survey created with the online program survey monkey and will be distributed to the employees of the two companies through email. Employees will first be asked for basic personal information so that the demographics of the group can be identified. They will then be asked to identify certain variables as constraints or resources, first in relation to their specific organization and then in general.

The personal questions will include questions about the participant's gender, age, level within the company, years with the company, and level of education. These questions may help to show certain trends within the responses to the surveys. After answering the first set of questions, the surveyed individuals will be given a series of 23 different variables and asked to identify them on a seven point scale with constraint on one end and resource on the other. The variables included in this survey are; money, ethical values, equipment, location, reputation, talent, technology, shareholders, competition, government regulations, social networking sites, deadlines, training, goals, creativity, teams, leadership, power, performance reviews, facility layout, data security, budgets, and inventory. Based on the resource-based view of the firm and the theory of constraints, there are seven variables from this list that are obviously constraints and seven variables that are obviously resources. The variables that are expected to be identified as constraints are equipment, government regulations, deadlines, goals, power, budgets, and inventory. The variables that are expected to be identified as

resources are location, reputation, talent, technology, creativity, teams, and leadership. The other nine variables; money, ethical values, shareholders, competition, social networking sites, training, performance reviews, facility layout, and data security are able to function conditionally as a constraint or a resource, or are unidentifiable as either one.

Results

Please contact the author for results and conclusions.

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STRUCTURING MOBILE WEBSITE DEVELOPMENT TO INCORPORATE MOBILE WEB BEST PRACTICES

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ABSTRACT

The number of users using mobile handheld devices to access mobile websites has grown exponentially within a few years. However, the quality of mobile websites is poor and contributes to unsatisfying user experiences. The W3C's Mobile Web Best Practices (MW) are de facto standards to improve the mobile website quality but in practice, these standards are overlooked due to time pressure, impracticability, and the absence of methodologies to incorporate the standards into the mobile website development. This paper presents a conceptual model that captures the mobile web development process for incorporating MW and in the sequel assuring the mobile website quality.

INTRODUCTION

The explosive growth of mobile handheld devices such as cell phones and personal digital assistants (PDAs) can be easily observed in recent years. As of July 2007, the number of mobile phone subscribers reached an astonishing 3 billion according to [10]. Worldwide mobile devices sales totaled 305 million units during the second quarter of 2008, an 11.8 % increase from the second quarter of 2007 [6]. This continual sales increase is supported by the need for anytime, anywhere access to information and services. The ability to communicate from virtually anywhere and the convergence of Web and wireless technologies has offered an unprecedented level of flexibility and convenience, particularly for ubiquitous information access through mobile devices.

The number of mobile device users accessing mobile websites in the United States has been rising. Nearly 1 in 3 mobile device users are accessing websites on their phones [13]. A survey conducted by the International Telecommunications Union (ITU), an agency of the United Nations, reported that there were 335 million mobile broadband subscribers across the World in 2009 [21]. The survey also reveals that the number of mobile broadband subscribers is expected to more than double by the end of 2013 with the fastest growth taking place in developing countries.

Businesses see the mobile Web as a new way to communicate and reach an increasing part of the Web audience: the mobile device users [24]. Business managers within various industries have become progressively aware of the mobile Web. Forty percent of major brands have already deployed mobile marketing campaigns; 89% of major brands are planning to market via mobile devices by 2008; and more than half of the brands in the next five years are planning to spend between 5 and up to 25% of their total marketing budget on mobile marketing [1]. [13] encourages the mobile trend and identifies seven reasons to go mobile:

1. There are 3 times as many mobile phones in the world than personal computers
2. Mobile makes your content ubiquitous
3. Mobile diversifies your audience
4. Mobile enables you to offer new types of services (e.g., location-based).
5. Mobile enables you to connect to patrons in a new medium
6. Mobile is the way of the future
7. It is easier than you think

Business's new communication strategy includes a mobile website. Web engineers cannot ignore the mobile Web anymore. They have to develop mobile websites.

The rest of this paper is organized as follows. Section 2 presents the mobile website quality problem and how it impacts businesses. Section 3 introduces the W3's Mobile Web Best Practices as a tool to solve the mobile website quality problem. The findings of a survey exploring the reasons behind the persistent mobile website quality problem are uncovered and our research question is revealed in Section 4. Section 5 investigates how to structure mobile website's quality assurance to answer our defined research question. Section 6 concludes and mentions future research directions.

MOBILE WEBSITES AND QUALITY PROBLEM

Faced with the rapid growth of mobile Web users, Web engineers are required to develop mobile websites. However, they are faced with a new set of challenges while developing mobile websites [13]. Most of the currently existing mobile websites suffer from poor quality to varying degrees [16]. Researchers qualify the overall mobile Web quality as poor [8], miserable or even oxymoronic [18]. Following the definition of quality proposed by [2], we define mobile website quality as *the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs*.

A mobile website quality problem exists. The mobile device cannot either display the websites at all, cannot display the website in a size that fits the mobile device screen [3], or can display the website but makes it difficult to interact with the website, i.e. difficult navigation through the web pages [16].

The mobile website quality problem has some consequences on the mobile users as well as on the businesses. Mobile users anticipate the same caliber experience on a mobile

website that they enjoy on a traditional website [13]. If a mobile website suffers from poor quality, mobile users are unable to access or interact with a significant part of the information included in the Web [9]. They may become confused or frustrated and may take their business to competing sites [4]. The success or failure of net-enabled businesses typically relies on the quality of the business' websites [20]. Nowadays, the business's websites include a mobile website. An A.T. Kearney report highlights that in the case of traditional websites, poor website quality costs retailers almost \$4 billion in revenues when transactions were not completed [25]. Previous studies in the e-commerce field have supported this fact by revealing that a quality website creates a positive attitude toward online stores, increases revisit rates, and eventually stimulates online purchases [14]. Poor quality websites increase return on investment [17]. One can argue that in the case of mobile websites, the poor mobile website quality is also costly. Mobile website quality is then crucial and has to be addressed.

W3C'S MOBILE WEB BEST PRACTICES

A standard can be defined as a documented agreement containing technical specifications or other precise characteristics to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose [12]. It enables agreement on solutions of recurrent problems [26]. As the first step to solve the recurrent mobile website quality problem, several companies and organizations have published their sets of mobile website quality standards. The World Wide Web Consortium (W3C) first published the Mobile Web Best Practices 1.0. in November 2, 2006 [28]. A newer and revised version of the document was released in July 28, 2008 [29]. The scope is based on the quality of the user's Web experience via a mobile device which depends significantly on the mobile website quality, browsers, and the device itself. Although the Mobile Web Best Practices recognize that browser usability and device usability are important (for reading, navigating, and interacting with content), their primary focus is the improvement of mobile website quality. They account 60 recommendations for delivering Web content to mobile devices.

Compared to the other mobile Web usability guidelines, the Mobile Web Best Practices stand out thanks to the following strengths:

- *Their universal acceptance:* They are published by the W3C that is universally recognized as the authority of the World Wide Web [23].
- *The way they are produced:* They were created by the Mobile Web Best Practices Working Group as part of the Mobile Web Initiative. This group consists of several members working in different international companies which have a common interest in mobile Web usability. This diverse group used the other sets of guidelines such as the iMode Guidelines have been sources of inspiration to create the Mobile Web Best Practices. Moreover, it interacts with the community at large. W3C as a whole includes more than 500 entities from very diverse industries. Representatives of interested parties work together on specifying and improving a standard. W3C focuses on improving the guidelines and listening to the general public feedback [29].

- *Their device-independent nature:* They are device-independent guidelines. Complying with the Mobile Web Best Practices ensures the mobile website quality on desktop computers and all mobile devices. The Mobile Web Best Practices do not pertain to a particular brand or model of mobile devices [29].

Consequently, the Mobile Web Best Practices appear as the most comprehensive de facto standards to test mobile website quality. The Mobile Web Best Practices have been created to support Web engineers to develop high quality mobile websites. However, nowadays, most mobile websites still suffer from poor quality. We utilize a survey to investigate this paradigm in the next section.

Mobile Web Best Practices	Abbreviations
Thematic Consistency	MW1
Capabilities	MW2
Deficiencies	MW3
Testing	MW4
URIs	MW5
Navbar	MW6
Balance	MW7
Navigation	MW8
Access Keys	MW9
Link Target ID	MW10
Link Target Format	MW11
Image Maps	MW12
Pop Ups	MW13
Auto Refresh	MW14
Redirection	MW15
External Resources	MW16
Suitable	MW17
Clarity	MW18
Limited	MW19
Page Size Usable	MW20
Page Size Limit	MW21
Scrolling	MW22
Central Meaning	MW23
Graphics For Spacing.	MW24
Large Graphics	MW25
Use of Color	MW26
Color Contrast	MW27
Background Image Readability	MW28
Page Title	MW29
No Frames	MW30

Structure	MW31
Table Support	MW32
Tables Nested	MW33
Tables Layout	MW34
Tables Alternatives	MW35
Non-text Alternatives	MW36
Objects or Script	MW37
Images Specify Size	MW38
Images Resizing	MW39
Valid Markup	MW40
Measures	MW41
Style Sheets Use	MW42
Style Sheets Support	MW43
Style Sheets Size	MW44
Minimize	MW45
Content Format Support	MW46
Content Format Preferred	MW47
Character Encoding Support	MW48
Character Encoding Use	MW49
Error Messages	MW50
Cookies	MW51
Caching	MW52
Fonts	MW53
Minimize Keystrokes	MW54
Avoid Free Text	MW55
Provide Defaults	MW56
Default Input Mode	MW57
Tab Order	MW58
Control Labeling	MW59
Control Position	MW60

TABLE 1: Mobile Web Best Practices and our abbreviations

SURVEY

We conducted an exploratory survey to identify why most of the currently existing mobile websites suffer from poor quality despite the existence of the Mobile Web Best Practices which provides guidelines to support the development of quality mobile websites. The survey was divided into categories including as demographics, the impact mobile Web usability standards have had on Web development, the awareness and understanding of mobile Web Best Practices, the levels of compliance to the Mobile Web Best Practices, and

the mobile website development methodologies.

Sixty- two Web engineers responded to the survey. Most survey respondents were young males living in the United States of America. They were educated and worked in diverse industries such as IT consulting and software development, healthcare, and education.

The exploratory survey results uncover that 71% of the survey respondents did not use the Mobile Web Best Practices. Three main reasons were found to explain this lack of usage:

- Web engineers lack time to develop a quality mobile website. They work under short deadlines and complying with the 60 Mobile Web Best Practices is time- consuming. [19] and [13] confirm that Web engineers have to manage the design of new websites or new versions of existing websites in very short time periods. Therefore, they don't have the time necessary to ensure mobile website quality.
- The Mobile Web Best Practices are complex and difficult to understand. Web engineers perceived them as impractical. [13] and [15] corroborate that Mobile Web guidelines can be overwhelming.
- A methodology for the incorporation of the Mobile Web Best Practices into the mobile website development is needed. [19] explain that if mobile website quality is evaluated, it is usually evaluated in the latter phases of the development process, when the website implementation is almost complete. Consequently, improving mobile website quality may then imply a complete redesign of the application, which cannot usually be afforded. A method to test the Mobile Web Best Practices during the mobile website development is needed. In the construction industry, the building standards are incorporated and tested at several points during the construction of a building.

We have discovered the following concerning the development of mobile websites and mobile website quality:

- (1) Web engineers cannot ignore the mobile Web anymore. They should develop mobile websites to reach the growing audience of mobile Web users.
- (2) Web engineers should develop quality mobile websites since a low quality level is a source of poor user experience. It deters the users which in return switch to the competitors. The low quality level of mobile websites is then costly.
- (3) Mobile Web Best Practices are the mobile website de facto quality standards issued by the W3C and a first step towards assisting Web engineers with developing quality mobile websites. The Mobile Web Best Practices have some strength, such as their device- independent nature, that others don't have. They appear as an effective instrument to promote mobile website quality. However, few mobile websites are compliant to the Mobile Web Best Practices.
- (4) The lack of compliance is the result of a lack of time, the impracticability of the

standards, and the absence of an agile methodology for the incorporation of Mobile Web Best Practices into the mobile website development lifecycle.

Consequently, a methodology is needed to incorporate the Mobile Web Best Practices into the mobile website development lifecycle.

STRUCTURING MOBILE WEBSITE'S QUALITY ASSURANCE

Categorizing Mobile Web Best Practices According to ISO Quality Characteristics

The International Organization for Standardization (ISO) has published the ISO 9126 series of standards [11]. The ISO 9126 addresses software quality from the product perspective. It divides software quality into six general categories of characteristics: functionality, reliability, usability, effectiveness, maintainability and portability. Each quality characteristic is composed of several sub-characteristics. Figure 1 presents the ISO 9126 Model – Software Quality Model.

As a first step towards answering our research question, we define each quality characteristic and its associated sub-characteristics and categorize the Mobile Web Best Practices according to the ISO9126's quality characteristics.

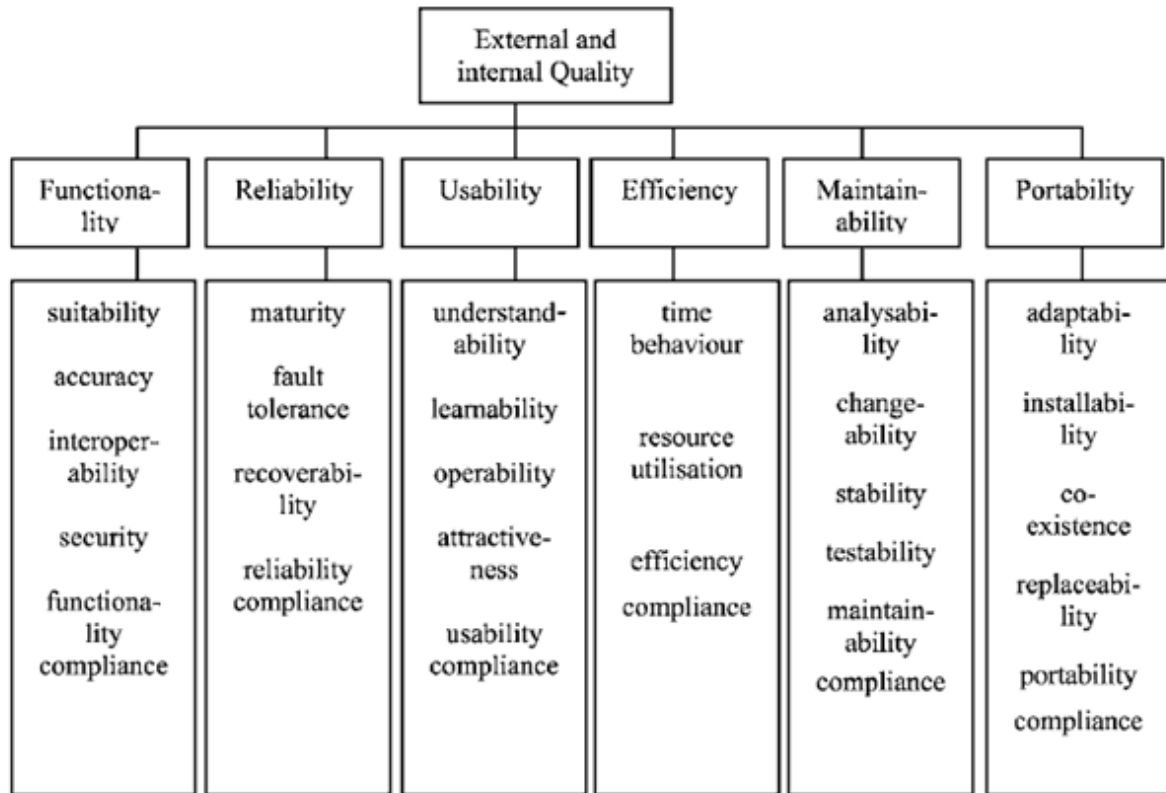


FIGURE 1: ISO 9126 Model – Software Quality Model [2]

Functionality is defined as the capability of the mobile website to provide functions which meet the users’ needs. It is composed of the following concepts:

- Suitability: The ability to have the adequate functions for the required tasks
- Accuracy: Capability to provide the right or agreed results or effects with the needed degree of precision.
- Interoperability: Capability to interact with one or more specified systems.
- Security: Capability to prevent unauthorized access to programs or data.
- Functionality compliance: Capability to adhere to Mobile Web Best Practices associated with mobile website’s functionality

If a mobile website element is not functional, the element cannot be displayed, is only partially displayed, or is displayed but doesn’t function properly on all or some mobile devices.

An example of Mobile Web Best Practices intended to test mobile website’s functionality is *No Frames*, MW30. MW30 recommends not using frames for the layout of the mobile website.

Many mobile devices do not support frames. In addition, frames are recognized as being generally problematic.

Reliability is defined as the capability of the mobile website to maintain its level of

performance under stated conditions for a stated period of time. It is composed of the following concepts:

- **Maturity:** Capability to avoid failures, as a result of faults in the site.
- **Fault tolerance:** capability to maintain a specified level of performance in case of software fault or of infringement of its specified interface.
- **Recoverability:** Capability to reestablish the level of performance, recover the data, and the time and effort needed for it.
- **Reliability compliance:** Capability to adhere to Mobile Web Best Practices associated with mobile website's reliability.

If a mobile website is not reliable, the user may encounter a deficiency in the mobile website and not be able to recover from it. An example of Mobile Web Best Practices intended to test mobile website's reliability is *Deficiencies*, M3. M3 suggests that because the software in mobile devices is frequently embedded in the device, there is no easy way to correct deficiencies once it is in the field. Mobile websites should then provide work-arounds for these deficiencies and differences in interpretation.

Usability is defined as the capability of the mobile website to be understood, learned, used and attractive to the user, when used under specified conditions. It corresponds to the relationship between the mobile websites and their users. It is composed of:

- **Understandability:** Capability to enable the user to understand how it can be used for particular tasks.
- **Learnability:** Capability to enable the user to learn its application.
- **Operability:** Capability to enable the user to operate and control it.
- **Attractiveness:** Capability to be attractive to the users.
- **Usability compliance:** Capability to adhere to Mobile Web Best Practices associated with mobile website's usability.

Usability involves the mobile website's ease of use from the user standpoint. It is proportional to the effort the user needs to invest in using the mobile website. On a mobile device, due to the restricted screen size, users must frequently scroll to see the contents of web pages. Furthermore, input devices associated with mobile devices are usually unpractical and make scrolling a difficult task for users. An example of Mobile Web Best Practices used to test mobile website's usability is *Minimize Keystrokes*, MW54. MW54 recommends for the interface to minimize user input. It advocates the use of selection lists, radio buttons, and other controls that do not require typing.

Efficiency is defined as the capability of the mobile website to provide appropriate performance, relative to the amount of resources used, under stated conditions. It is composed of:

- **Time behavior:** Capability to provide appropriate response time, processing time and throughput rates when performing its function under stated conditions.
- **Resource Utilization:** Amount and type of resources used and the duration of such use in performing its function.
- **Efficiency compliance:** Capability to adhere to Mobile Web Best Practices associated with mobile website's efficiency.

The mobile website's efficiency is dependent on the delay involved in downloading mobile Web pages and their elements, the cost and the memory consumption resulting from these downloads. An example of Mobile Web Best Practices used to test mobile website's efficiency is *External Resources*, MW16. MW16 advises to limit the number of external resources. Each linked resource such as images, style sheets, and other objects requires a separate request across the network. This may add significantly to the load time of the page in the mobile context.

Maintainability is defined as the capability of the mobile website to be modified. Modifications may include corrections, improvements, or adaptations of the site to changes in the environment. It is composed of:

- Analyzability: Capability to be diagnosed for modifications.
- Changeability: Capability to enable a specified modification to be implemented.
- Stability: Capability to avoid unexpected effects from modifications.
- Testability: Capability to be validated.
- Maintainability compliance: Capability to adhere to Mobile Web Best Practices associated with mobile website's maintainability.

Mobile website requirements rapidly change over time. Modifications are then frequent. The agility of the mobile Web development lifecycle should allow for ease of maintainability. One Mobile Web Best Practices deals with maintainability. *Testing*, MW4, advocates carrying out testing on actual devices as well as emulators. Several mobile device manufacturers provide mobile device emulators. MW4 emphasizes the importance of testability and how to perform the testing.

Portability is defined as the capability of the mobile website to be transferred from one environment to another. It is composed of:

- Adaptability: Capability to adapt to different specified environments.
- Installability: Capability to be visible in a specified environment.
- Co-existence: Capability to co-exist with other independent sites in a common environment, sharing common resources.
- Replaceability: Capability to be used in place of another specified site for the same purpose in the same environment.
- Portability compliance: Capability to adhere to Mobile Web Best Practices associated with mobile website's portability.

The mobile website environment includes the hardware environment. Mobile websites should be able to be displayed on all types of mobile devices. An example of Mobile Web Best Practices used to test portability is *Thematic Consistency*, MW1. MW1 aims at ensuring that a mobile website yields a thematically coherent experience when accessed from different devices. The mobile website should be accessible on a range of devices irrespective of differences in presentation capabilities and access mechanism.

Table 2 presents the categorization of the Mobile Web Best Practices by quality characteristics. Figure 2 represents a graphical representation of this categorization. Some Mobile Web Best Practices exclusively test one quality characteristic while others test several quality characteristics.

Quality Characteristics	Mobile Web Best Practices
Functionality	MW12, MW13, MW17, MW19, MW21, MW24, MW26, MW27, MW28, MW30, MW32, MW33, MW34, MW35, MW37, MW40, MW43, MW46, MW47, MW48, MW49, MW52, MW53
Reliability	MW3, MW50
Usability	MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW18, MW20, MW22, MW23, MW25, MW26, MW27, MW28, MW29, MW31, MW32, MW33, MW34, MW35, MW36, MW41, MW50, MW51, MW53, MW54, MW55, MW56, MW57, MW58, MW59, MW60
Efficiency	MW7, MW10, MW11, MW13, MW14, MW15, MW16, MW20, MW25, MW29, MW37, MW38, MW39, MW42, MW44, MW45, MW46, MW52
Maintainability	MW4
Portability	MW1, MW2, MW3

TABLE 2: Categorization of the Mobile Web Best Practices by Quality Characteristics

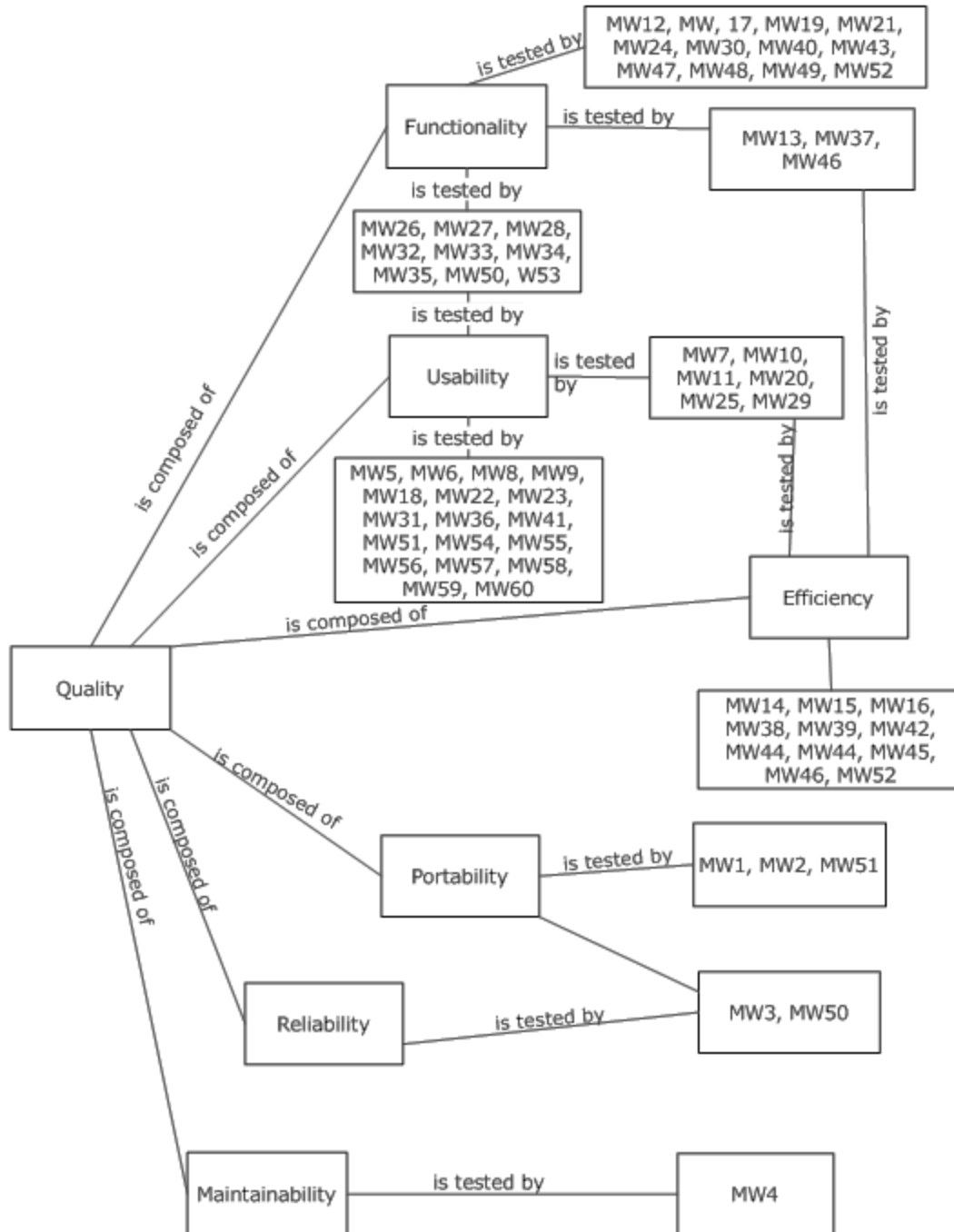


FIGURE 2: Categorization of the Mobile Web Best Practices by Quality Characteristics

Mapping Mobile Web Best Practices into the Mobile Website Development Lifecycle

From traditional software development methodologies to hypermedia development methodologies, Web engineers have the choice between multiple mobile website development methodologies. They have also the choice between several strategies to develop their mobile websites as presented by [21].

Independently from the development methodologies and strategies selected, the mobile website development lifecycle (MWDLC) is composed of the following phases: planning phase, analysis, phase, design phase, testing phase, and implementation phase. The MWDLC needs to be agile to respond to challenges as characterized by short-time development cycles and frequent requirement changes.

As a second step towards answering our research question, we identify when the Mobile Web Best Practices should be tested within the five MWDLC phases to ensure the mobile website quality. Most of the Mobile Web Best Practices are related to the design of the mobile website. The design phase can be composed of Navigation, Presentation, and Content. This composition has been proposed by researchers such as [5], [7], and [22]. Navigation articulates all hyperlinks including links between the Web pages of the mobile websites and the external links. Presentation expresses the layout and graphic appearance of pages. Content corresponds to the information provided by the site via text and graphics independently from their presentation. The classification of the Mobile Web Best Practices by MWDLC phases is presented in Table 3 and graphically in Figure 3.

MWDLC Phases		Mobile Web Best Practices
Planning		
Analysis		MW2, MW3, MW5, MW7, MW15, MW16, MW17, MW19, MW20, MW26, MW51, MW52
Design	Navigation	MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW16, MW45, MW58
	Presentation	MW1, MW2, MW13, MW17, MW22, MW24, MW25, MW26, MW27, MW28, MW30, MW31, MW32, MW33, MW34, MW35, MW36, MW37, MW38, MW39, MW40, MW41, MW42, MW43, MW44, MW45, MW50, MW51, MW53, MW54, MW55, MW56, MW57, MW58, MW59, MW60
	Content	MW16, MW17, MW18, MW19, MW20, MW21, MW22, MW23, MW25, MW29, MW36, MW37, MW46, MW47, MW48, MW50, MW51, MW54, MW55, MW56, MW59, MW60
Testing		MW1 to MW60
Implementation		

TABLE 3: Classification of the Mobile Web Best Practices by MWDLC Phases

We used an exploratory case study to help us classify the Mobile Web Best Practices by MWDLC phases. The case study involved the development of a mobile website for the J.

Whitney Bunting College of Business at Georgia College & State University.

During the planning phase, Web engineers attempted to identify the scope of the mobile website, ensure its financial feasibility, staff the project, and launch the project. We found that no Mobile Web Best Practice was directly associated with the planning phase.

During the analysis phase, Web engineers define the mobile website requirements and prioritize them. They draw storyboards, which represent the different Web pages and their relationships. They also decide on the URI for the mobile website. Among the requirements, they establish the basic functions the mobile website should possess and select the tools such as forms used to achieve the functions. An example of Mobile Web Best Practices who should be incorporated into the MWDLC analysis phase is *URI*, MW5. MW5 advocates keeping the URIs of site entry points short.

During the design phase, Web engineers designed the mobile Web pages resulting on the creation of a mobile website prototype. An example of Mobile Web Best Practices who should be incorporated into the MWDLC design phase is *Clarity*, MW18. MW18 recommends using clear and simple language. It affects the content design.

During the testing phase, Web engineers tested the mobile website with emulators and mobile devices. A final and comprehensive test should be performed to ensure the compliance of the mobile website with the 60 Mobile Web Best Practices before implementation.

During the implementation phase, the mobile website was released to the public.

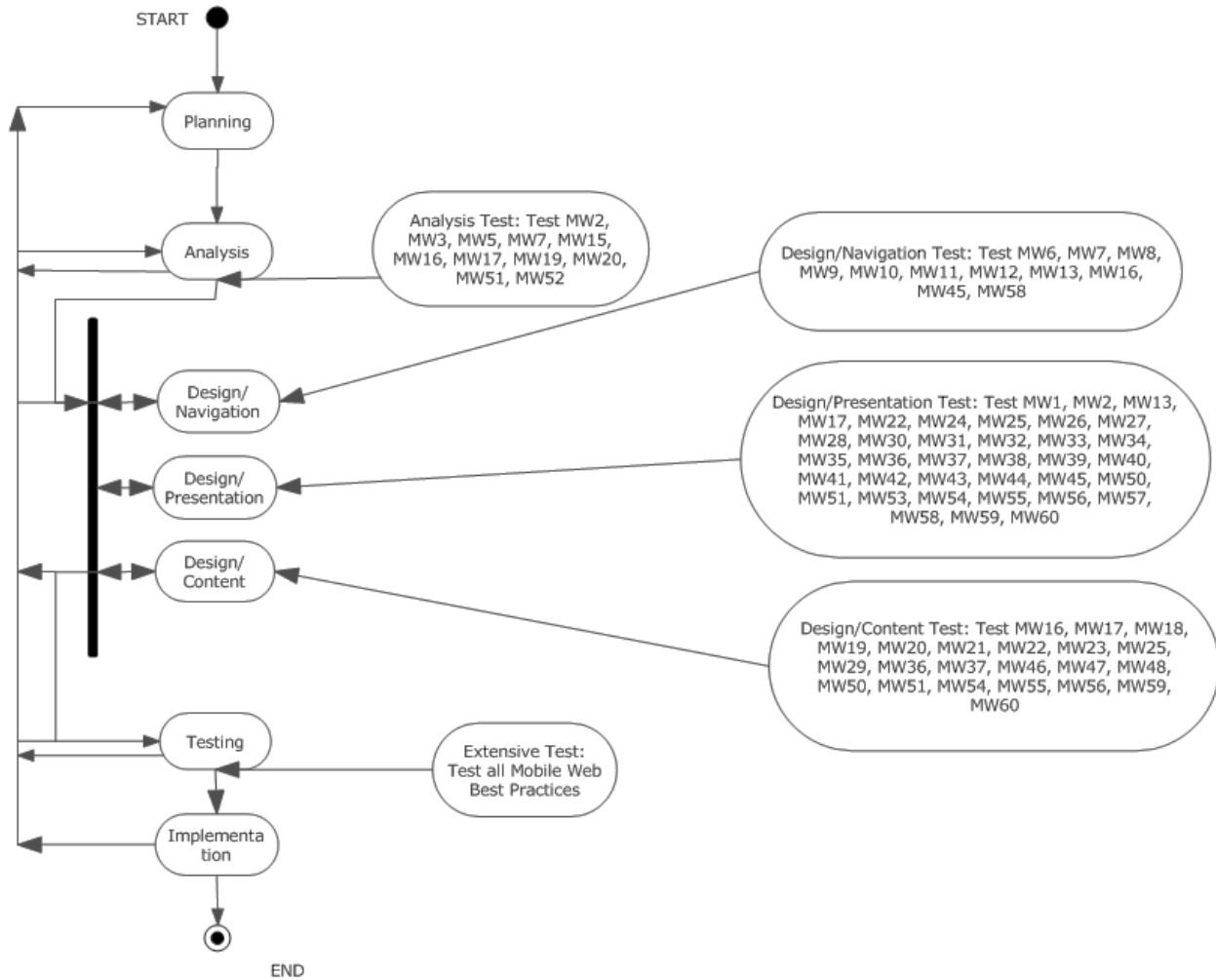


FIGURE 3: Classification of the Mobile Web Best Practices by MWDLC Phases

Modeling Quality Assurance for Mobile Website Development

As a third step towards answering our research question, we reconcile the categorization of the Mobile Web Best practices by quality characteristics from section a., and the classification of the Mobile Web Best Practices by development phase from section b. The reconciliation presents, the Mobile Web Best Practices used to test the quality characteristics associated with each MWDLC phase. Mobile website quality is ensured by testing the compliance of the mobile website with the Mobile Web Best Practices associated with each quality characteristic during the different MWDLC phases as presented in Figure 4.

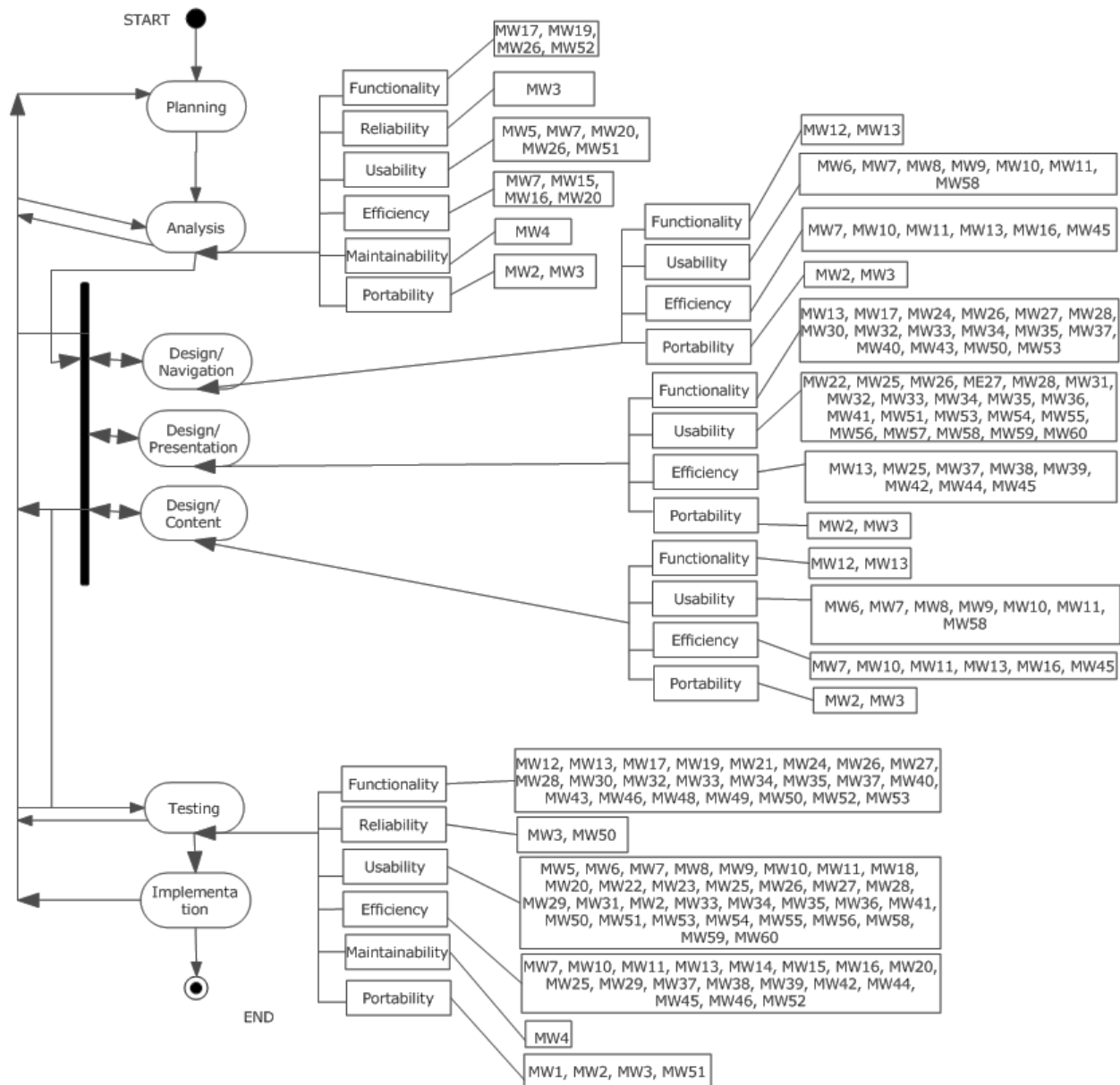


FIGURE 4: Relationships between MWDLC Phases, Quality Characteristics, and Mobile Web Best Practices

Resulting from the three different steps we have taken to answer our research question, we propose a model of quality assurance for mobile website as presented in Figure 5.

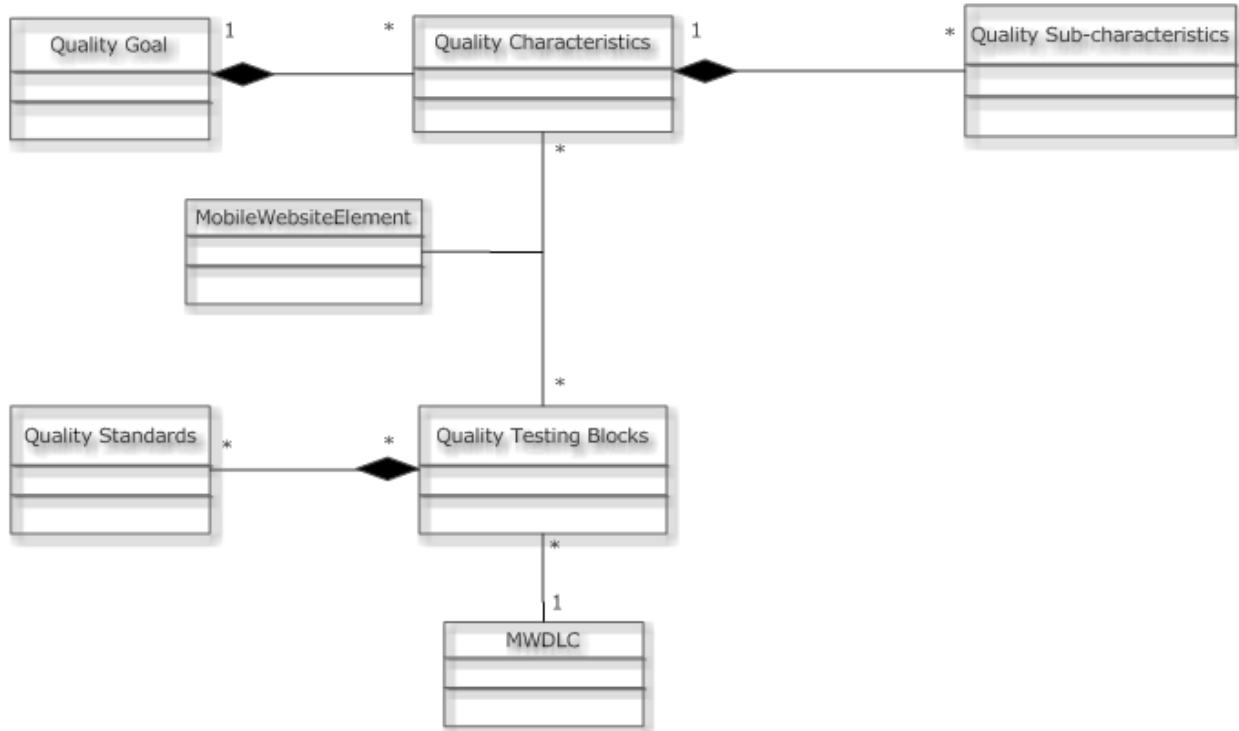


FIGURE 5: Quality Assurance Model for Mobile Website

CONCLUSIONS AND FUTURE WORK

Despite the exponential growth of mobile users, mobile websites suffer from poor quality. The Mobile Web Best Practices attempt to solve this quality problem. However, they are rarely used and are seen as time-consuming and unpractical. This paper has offered an approach to incorporate the Mobile Web Best Practices into the mobile website development lifecycle in order to improve the mobile website quality. Based on the quality characteristics and the MWDLC phases, we have modeled quality assurance for mobile website development. We intend to pursue our research by uncovering the conceptual foundation of our theory and build a prototype to test and evaluate the feasibility of our theory.

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Online Brand Advertising: How to Create Digital Brands through Interactive Advertising

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Online Brand Advertising: How to Create Digital Brands through Interactive Advertising

Abstract: Companies are looking for the best way to advertise their products and services. Brand-advertising through the internet has become very popular. On-line advertising can help increase the awareness and perception of brands and alter consumers' beliefs and attitudes positively. The research discusses the history, growth, and development of online advertising, and how it has become so effective over the years. The study focuses on how online advertising benefits the companies by branding their products and services, and creates bonding with the consumers. The different dimensions of online brand-advertising are explored in the study. The research study focuses on the following research questions.

- What is the effectiveness of brand-advertising on-line?
- Is brand-advertising through the internet the best way to advertise, or is it better to use traditional advertising?
- How are the digital brands created and maintained?

The research study suggests various marketing and advertising strategies required for the creation and sustenance of digital brands.

Keywords: Digital Brands, Online Brand Advertising, Attitudes towards the ad, attitudes towards the brand

Introduction

Online advertising is a form of marketing used to raise awareness about a product or service through the internet. For many years companies have been searching for the most effective way to advertise their business. Companies have now become aware of the more effective forms of advertising and have been pleased with the results (Kameya, A., & Zmija, K., 2002). As technology changes so does the world of advertising. The internet has become such a convenient tool, because so much can be done through the internet. This makes the internet a big playing field for companies to advertise. Since the first banner ads appeared in 1994, the internet advertising industry has experienced exceptional growth (Hand, C., Robinson, H., & Wysocka, A., 2007). On every webpage one accesses they will see at least one form of advertisement. Search engines have even leaked similar advertisements to what you are searching for. If a consumer were to type "soap brands" in the search bar on Google different advertisements for soap brands will appear on the right hand side as Google AdWords, or they will appear above the search

results as Google AdSense. This is Google's way of allowing companies and individuals to advertise their products and services through their search engine.

Traditional advertising is produced through television, radio, billboards, and print ads like magazines newspapers, and flyers. Traditional ads make it easier target a specific target area. Although online advertising has its advantages so does traditional advertising. Figure 1 depicts their framework of consumer's perception on ad. Motive affects the perceived values on the six factors. These six factors are expected to affect ad attitude within both the traditional and the Internet environment but with different degrees (Wang et al., 2002).

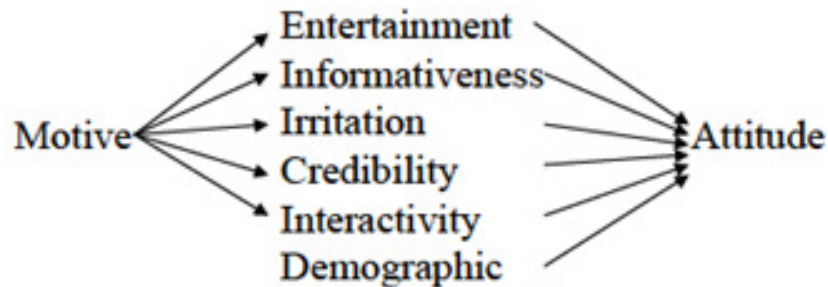


Figure 1: Factors Contributing to Attitude towards Advertising Model (Wang et al., 2002)

In order to better understand the effectiveness of internet advertising, therefore, we must examine unique characteristics of the internet advertising formats and develop new criteria by which the effectiveness of internet advertising can be assessed (Li & Leckenby 2004). Rodgers & Thorson (2000) provide an integrative processing model of Internet advertising, which incorporates the functional and structural schools of thought, as shown in Figure 2.

Interactive Advertising Model (IAM)

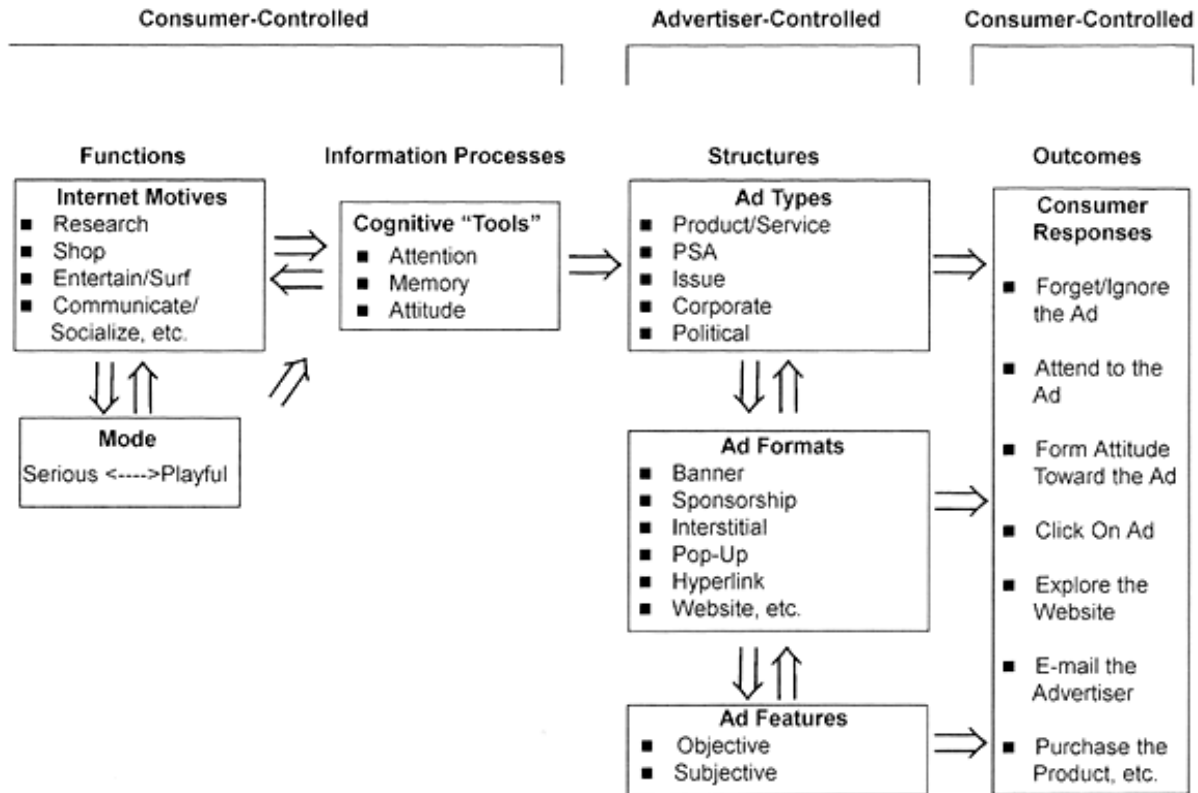


Figure 2: IAM Model (Rodgers & Thorson, 2000)

Conceptual Framework

Figure 3 illustrates the conceptual framework of attitude towards advertising model. As shown in figure 3, there are nine motives that produce an attitude towards online advertising. These nine factors trigger the consumer's reaction to the online advertisements. The author believes that the following three factors should be included in the Factors Contributing to Attitude towards Advertising Model: Creativity, Ad Type, and Perceptions. Creativity is a contributing factor, because it is one of the main reasons a consumer is persuaded to purchase a product. A consumer may be used to another brand, but decides to try another brand due to its creative advertising.

Ad Type is a contributing factor, because some consumers may see a print ad as ineffective or not providing enough information to interest them versus a commercial that gives thorough information

about a product or service through verbal and visual communication. The form of advertising used has a direct affect on consumers.

Perception is a contributing factor to the model, because a consumer may see a print ad from a negative aspect. As a result of the negative aspect the consumer will not want to purchase the product. If the consumer were to see a commercial for the same product, and saw it in a positive aspect in which they are convinced to purchase the product.

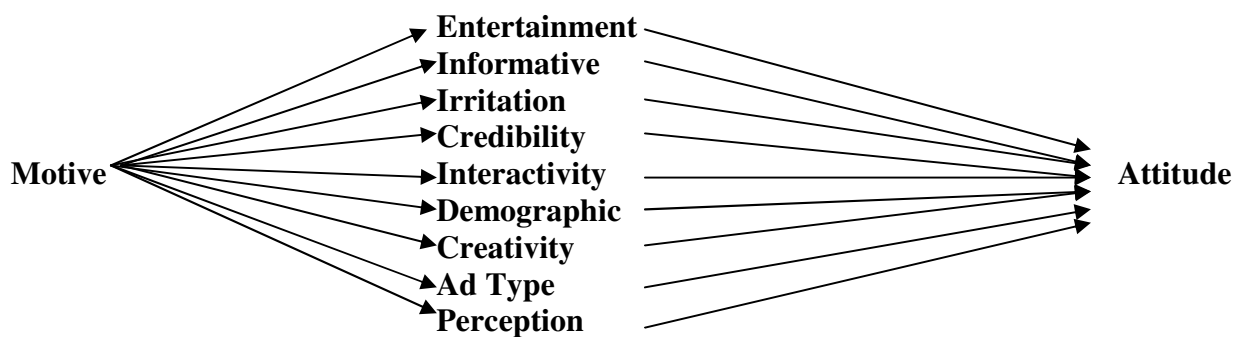


Figure 3: Attitude towards Online (Interactive) Advertising Model -Conceptual Framework

Conclusion

Digital brands can be very effective if they appeal to the consumers. Most digital brands need more than just a picture to sell their product. Advertisers should perform surveys to see which of their advertisements is the most effective. Then the advertiser should enhance and mimic the advertisement for future products. Digital branding is going to expand as technology expands. The internet is not the only place that digital is exist anymore. From the digital billboards to the internet (social / viral) ads, digital brands are evolving.

An online interactive advertising attitude model is conceptualized in this research. Empirical testing of the model needs to be focused in the future research. Future research may focus on the interactions between online (interactive) and offline advertising and branding models.

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A GRAVITY MODEL OF ASIAN NATIONS TRADE USING PANEL DATA¹

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ABSTRACT

This project estimates a gravity model of international trade in Asia. Panel data regression analysis is employed in this study. Annual data for 6 member countries of AFTA (Singapore, Thailand, Malaysia, Philippines, Vietnam, and Cambodia) as well as for China, Japan and Korea during the period of 1990 to 2008 were collected for the purpose of this research. With bilateral exports between any pair of countries serving as our dependent variable, we offer results from four estimated models: ordinary least squared (OLS), and three specialized panel methods, First Differences (FD), Fixed Effects (FE), and Random Effects (RE). We find that the GDP of both the exporter and importer are important determinants of bilateral trade, while distance has, in general, the anticipated effects when these measures enter the estimation. We also find that ASEAN Free Trade Agreement does not seem to be important at all in our study, and this result contradicts with some earlier studies. Another important finding is that exchange rate volatility is significant and has negative effects only for China's trade with the other nations in the data set. The latter result may be due to China's policy of (mostly) fixed exchange rates vis-à-vis the US dollar.

INTRODUCTION

There are two major objectives of this paper, the first one is to evaluate the determinants of bilateral trade flows among 9 Asian nations, the second one is to particularly investigate the impact of ASEAN² Free Trade Area (AFTA) in Asia. For the purpose of this study, annual data in panel format were collected for 6 member countries of AFTA (Singapore, Thailand, Malaysia, Philippines, Vietnam, and Cambodia) as well as China, Japan and Korea. The period under study is from 1990 (before AFTA was formed) to 2008. Panel data regression analysis is employed in this study since the data have both a cross section characteristic (different nations) and also time dimension (the years from 1990-2008). The trade determinants examined in this study include the following: one country's export to a given country, GDP of both the exporter and the importer, geographic distance between the two countries' capital cities, the variation in exchange rates between two countries, and finally a dummy variable which indicates whether or not a country is in AFTA.

¹ This research was sponsored by the Shapiro Undergraduate Research Fellowship (SURF) of Randolph-Macon College.

² The Association of South-East Asian Nations, founded on August 8th, 1967 in Bangkok, is a geo-political and economic organization for 10 countries in Southeast Asia.

A BRIEF DESCRIPTION OF THE GRAVITY MODEL

The name “gravity model of trade” derives from the similarity of the model to Newtonian physics, specifically Newton’s law of universal gravitation. Newton’s theory states that the force attracting two masses is proportional to the product of the two masses and inversely proportional to the distance between the two masses. The gravity model of trade, first introduced by Jan Tinbergen in 1962, posits that trade between two nations will be proportional to the product of the size of the two nations (as measured by GDP, or some other indicator of size) and inversely proportional to the distance between the two nations. For example:

$$T_{ij} = A \frac{M_i^{\beta_1} M_j^{\beta_2}}{D_{ij}^{\beta_3}}$$

Where

T_{ij} = some measure of trade flows between nations i and j ,

M_i = a measure of the size of nation i (here GDP),

M_j = a measure of the size of nation j (here GDP),

D_{ij} = the distance between nations i and j , and

A = a constant

The multiplicative nature of the model leads to a specification in natural logs that allows for linear estimation techniques. That general form is:

$$\ln T_{ij} = \ln A + \beta_1 \ln M_i + \beta_2 \ln M_j - \beta_3 \ln D_{ij} + \varepsilon_{ij}$$

Where \ln stands for the natural logarithm, the variables are defined as above, and ε_{ij} represents the error term. Gravity model provides an accepted framework of trade flows, and has been widely used in explaining the determinants of trade flows of countries. A number of explanatory variables have been added to the basic gravity equation to improve explanatory power of the model.

LITERATURE REVIEW

According to Srivastava and Green (1986), “Perhaps the most widely quoted study on the determinants of trade was conducted by Linneman (1966).” Linneman used gross national product, population, distance and a preferential trade factor (which was essentially a dummy variable correlated to a particular “sphere of influence”) as his independent variables. In this study Linneman found that all of these variables were of statistical significance with gross national product and distance having greatest explanatory value and the others having very little.

Srivastava and Green (1986) used Linneman’s study as a starting point in their research using gross domestic product and distance while adding “political instability, membership in specific economic unions, and such cultural factors as religion and language,” as independent variables. The study reported that 30.95% of the variance in trade was explained by these 6 variables, with distance accounting for about half. Similar to Linneman, this study found that distance was the most important determinant of bilateral trade. Linneman also reported that, apart from distance,

“only the GDP of the exporting country and the population of the importing country have additional significant effects on the dependent variable.” The cultural and political variables included were found to be statistically significant yet not highly explanatory.

More recent studies focus on the effects of multilateral agreements and economic integration on international trade. A study by Baier and Bergstrand (2004) attempted to answer the question “Do Free Trade Agreements Actually Increase Members’ International Trade?” Previous studies provided contradictory evidence on the statistical significance of free trade agreements, most giving it very little weight. Baier and Bergstrand (2004) attribute much of this to bias caused by using cross-sectional data. They suggest that “the best method to estimate the effect of FTAs on bilateral trade flows employs a theoretically-motivated gravity equation using differenced panel data.” With this method, Baier and Bergstrand estimate that a free trade agreement will “on average increase two member countries’ trade about 86 percent after 15 years.” Kien and Hashimoto (2005) provided additional support to Baier and Bergstrand’s research results. They employed the Hausman-Taylor estimation and a country panel data of 39 countries for the period 1988-2002 to examine the determinants of trade flows of ASEAN Free Trade Area (AFTA). The research suggested that export flows among two member countries increase more proportionately with GDPs. A more important result was that AFTA only produced trade creation³ among its members.

The study conducted by King, Ismail and Hook (2009) aims to look at the impact of ASEAN Economic Community (AEC) on the intra-trade among ASEAN member countries at an aggregate level. Their gravity model employs in panel estimation from 1993 to 2006 between ASEAN-5 members and 40 trading partners. Similar to previous researches, this study finds that GDP, population, relative endowment, distance and common border are the major determinants of bilateral trade in ASEAN. The ASEAN dummies that measure the intra ASEAN trade confirm that there is trade creation among the five ASEAN members, namely Indonesia, Malaysia, Philippines, Singapore and Thailand.

There has not been a great deal of research done on the matter of exchange rate volatility and its effect on trade until very recently, and the evidence is somewhat contradictory. For example, research by Thursby and Thursby (1986) provides evidence of a significant, negative relationship between exchange rate volatility and bilateral trade in ten of the seventeen countries they examined. Similarly Koray and Lastrapes (1989), report some negative impact on trade, however they consider it to be a very weak relationship. More recently however, Dell’Ariccia (1998) presented evidence that exchange rate uncertainty has a significant negative effect on international trade. He did so through the use of the gravity model and panel data from Western Europe. Dell’Ariccia’s work is somewhat similar to ours here.

Larson, Bittencourt and Thompson (2005) conducted research to capture the effects of medium to long run bilateral real exchange rate volatility on Brazilian sectoral trade. The research indicates that the size of exchange rate volatility is an important factor affecting international trade in the long run and exchange rate changes have different impacts on different sectors, due

³ Economists distinguish between trade creation, defined as the additional trade between partners in a preferential trade agreement due to the agreement, and trade diversion, the increase in trade that is diverted from other nations who are not members of the agreement.

to specific characteristics of each industry. Brazil's trade is negatively affected not only by its own exchange rate movements, but also by those of its Mercosur partners.

Though the gravity model of trade has been widely used for its empirical success, several economists argued that results generated by standard cross-sectional methods are biased results because they do not control for heterogeneous trading relationships. Therefore, Fixed-effects which allow for unobserved or misspecified factors that simultaneously explain trade volume between two countries were introduced into the gravity equation. The research conducted by Cheng and Wall (2005) evaluate the various fixed-effect specifications in terms of the econometric appropriateness of their underlying assumptions. They suggest a two-way fixed-effects model in which country-pair and period dummies are used to reflect the bilateral relationship between trading partners to be used to eliminate bias.

Economists also have been interested in the impact of currency unions on trade. Rose (2000) first estimates the effect of currency unions on trade in a cross-sectional study and finds that adopting a currency union leads to a 200% increase in bilateral trade. It is also found that the increase in trade between countries sharing a common currency is not due to trade diversion from other partners but due to an increase in total trade. These very high estimates have led to a controversy. Bun and Klaassen (2007) estimate the gravity equation allowing for country pair specific time trends to account for trending behavior observed in the residuals. Their estimate of the Euro effect on bilateral trade was reduced to about 3%. Gengenbach (2009) employed recently advanced methods in the analysis of non-stationary panel data with cross-sectional dependence. The research result supports Bun and Klaassen's finding in 2007.

AN OVERVIEW ON ASEAN AND AFTA

ASEAN was established on August 8th, 1967 in Bangkok by 5 original members, Indonesia, Malaysia, Singapore, Philippines and Thailand. By that time the trade among these member countries was very insignificant. According to the statistics, the share of intra-ASEAN trade was only between 12-15% during the early 1970s. Brunei Darussalam then joined ASEAN on January 8th, 1984, Vietnam on July 28th, 1995, Lao PDR and Myanmar on July 23th, 1997, and Cambodia on April 30th, 1999, making up what is today the ten Member States of ASEAN. The aim of ASEAN includes the acceleration of economic growth, social progress, cultural development among its members, the protection of the peace and stability of the region.

To strengthen economic cooperation between ASEAN members, ASEAN Free Trade Area (AFTA) was established in January 1992. The mission of this agreement is to eliminate tariffs and non-tariff barriers among members and attract Foreign Direct Investment (FDI) to ASEAN. The major tool of the tariff reduction is the Common Effective Preferential Tariff (CEPT) scheme, which required tariffs to be reduced to less than 5% by 2008. Since AFTA was established, the amount of total trade among member countries has grown from \$44.2 billion in 1993 to \$1521.28 billion in 2009. Intra-ASEAN trade made up 24.2% of total ASEAN trade in 2009.

DATA

We collected data on bilateral combinations in a panel of 6 member countries of AFTA as well as China, Korea and Japan. The data spans the period between 1990 and 2008. Thus we have a

panel with N=72 country pairs and T=19 time series observations. Thus the total number of observations is 1368 (9*8*19 = 1368). Data for the following variables were collected based on their importance and inclusion in the gravity models shown in previous researches performed.

X _{ij}	=	Country i exports to country j
GDP_E	=	Total GDP of the exporter for a given year
GDP_I	=	Total GDP of the importer for a given year
VARE	=	A measure of the total variation in exchange rate for a given year
DIST	=	Geographic distance between the two countries' capital cities
FTA	=	Dummy variable for free trade agreement (1=Yes 0=No)

Much of the data collected for this study were found on the International Monetary Fund's Direction of Trade Statistics and International Financial Statistics databases. Our method for measuring exchange rate volatility or VARE is to compute the squared percentage deviations in the bilateral exchange rates for each of the 9 nations on a monthly basis, and then accumulating those individual series for each year. Thus this VARE yields a measure of volatility within a given year. Data for distance were mainly found on CEPII Distances Database, and others were computed by using the distance calculator on Export911.com. Distances are computed by latitude and longitude of each capital city provided on their website.

METHODOLOGY

Panel regression analysis⁴ is employed in this study since the data have both a cross section characteristic (different nations) and also time dimension (the years from 1990-2008). Four different regression methods were used: ordinary least squares (OLS), first differences (FD), fixed effects (FE), and random effects (RE).

The following general estimation model was used for first differences and fixed effects:

$$\log(X_{ij}) = \beta_0 + \beta_1 \log(\text{GDP_E}_t) + \beta_2 \log(\text{GDP_I}_t) + \beta_3(\text{VARE}_{it}) + \beta_4(\text{FTA}_{it}) + \varepsilon_{it}, \quad (1)$$

where the variables are defined as above, i indicates the export country, j indicates the import country and t represents the year of the observation (t = 1990 – 2008).

The dependent variable is country i exports to country j (X_{ij}). The first two independent variables are total GDP of the exporter (GDP_E) and that of the importer (GDP_I). The other two variables included are a dummy for free trade agreements and our estimate of exchange rate volatility. The variables for distance is omitted in the first differences and fixed effects estimations due to the fact that any variable that is constant over the given time period will automatically drop out of the equation with either first differences or fixed effects estimations.

The following estimation model is used for the random effects (RE) and ordinary least squares (OLS) methods:

⁴ The Appendix to this paper contains a description of panel data regression methods.

$$\log(X_{ij}) = \beta_0 + \beta_1 \log(\text{GDP}_{E_t}) + \beta_2 \log(\text{GDP}_{I_t}) + \beta_3 (\text{VARE}_{it}) + \beta_4 \log(\text{DIST}_{ij}) + \beta_5 (\text{FTA}_{it}) + \varepsilon_{it}, \quad (2)$$

Unlike the first differences and fixed effects, RE and OLS allow the effects of variables that remain constant over the given time series to be estimated, and therefore the distance variable is included.

RESULTS

Table 1 contains the results of the estimations for each of the four methods of estimation for all countries.

Table 1: Alternative Gravity Model Estimations				
Explanatory Variable	Ordinary Least Squares	First Differences	Fixed Effects	Random Effects
Constant	2.897 (-7.01)	----	----	5.766 (2.73)
Total Exporter GDP	1.03 (52.19)	0.669 (7.18)	0.722 (15.62)	0.81 (19.89)
Total Importer GDP	0.781 (40.31)	0.681 (7.49)	1.13 (24.76)	1.04 (25.83)
Free Trade Agreement	1.077 (11.66)	-0.119 (-1.39)	-0.019 (-0.28)	0.003 (0.04)
Currency Volatility	-0.053 (-3.00)	0.004 (0.62)	0.003 (0.28)	0.002 (0.17)
Distance	-0.708 (-12.53)	----	----	-1.06 (-3.83)
\bar{R}^2	0.74	0.0456	0.9464	
SEE	1.3028	0.4647	0.5913	0.5766

(t-statistics in parentheses below parameter estimates.)

Ordinary Least Squares

First consider the ordinary least squares estimation (OLS). Each explanatory variable is statistically significant and the equation has a high degree of explanatory power ($\bar{R}^2 = .74$). The estimated coefficients are estimates of elasticities due to the double log nature of the estimation. So, for example, the elasticity of exports with respect to GDP of the import nation is estimated to be approximately .8, meaning that a 10% increase in the GDP of the import nation increases exports by 8%. However, we do not place much confidence in the OLS estimates. OLS is often not the appropriate method. The application of OLS to panel data assumes that coefficients (including intercepts) are constant across individuals (countries here) and over time. Varying intercepts would mean that unobserved effects are present across countries, meaning that some effects on trade such as tastes and preferences are not (and maybe cannot) be included in the explanatory variable set. Fortunately, a simple test can be employed that will indicate whether such individual effects are in fact present, and thus determine the appropriateness of ordinary

least squares. This test augments equation (1) by adding $i - 1$ dummy variables ($D_1, D_2, D_3 \dots D_{71}$ [since there are 72 pairs of bilateral trade partners]) in order to test for individual effects as follows:

$$\log(X_{ij}) = \beta_0 + \beta_1 \log(\text{GDP_E}_t) + \beta_2 \log(\text{GDP_I}_t) + \beta_5 (\text{VARE}_{it}) + \beta_6 \log(\text{DIST}_{ij}) + \beta_7 (\text{FTA}_{it}) + \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3 + \dots + \alpha_{71} D_{71} + \varepsilon_{it}, \quad (1')$$

From (1') we test that if the α_i coefficients are jointly zero, i.e.,

$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \dots = \alpha_{71} = 0$ (there are no country effects)

$H_1: \text{some } \alpha_i \neq 0$ (one or more country effects are present)

The F-test returns a value of 760.5, indicating that the α_i are (very) significantly different from zero, thus rejecting OLS as an appropriate method for this panel data set. For an appreciation of the graphical nature of individual country effects, see Figure 1 in the section on China.

First Differences

Given that OLS has been determined to be an inappropriate technique for this panel data, we perform three other estimations. The third column in Table 1 contains the estimated coefficients for the first differences method. Here we find the exporter GDP and importer GDP to be statistically significant in explaining bilateral trade. Neither exchange rate volatility nor the Free Trade Agreement variable is statistically significant in this first differences regression. Note that since the AFTA started in 1993 and various countries joined in different years, the dummy variable for the FTA does not drop out under first differences, as would dummy variables that are “on” for the entire time period—but the dummy variable has relatively little variation. The explanatory power of this regression is relatively low ($\bar{R}^2 = .0456$), as low values of \bar{R}^2 are common in first differences regressions.

Fixed Effects

The fixed effects method finds similar results as the first differences method. The explanatory power of this regression is quite high ($\bar{R}^2 = .9464$). The exporter GDP and the importer GDP are statistically significant in explaining bilateral trade, the elasticity of trade with respect to the export nation's GDP is estimated to be .72 and the elasticity of trade with respect to the importer's GDP is estimated to be 1.13. Exchange rate volatility and the Free Trade Agreement variable are not statistically significant.

Random Effects

Random effects panel regression methods have the advantage that variables which are constant over time (here distance between countries) can be included in the regression's explanatory variable set. The random effects method yields estimates for the coefficients of variables in common with the fixed effects method that are strikingly similar. The exporter GDP and the importer GDP are statistically significant in explaining bilateral trade. Neither of exchange rate volatility nor the free trade agreement variable is statistically significant. For the additional

variable included in the RE estimation, we find distance to be statistically significant and have negative effects on bilateral trade. However, the Hausman test indicates that random effects regression should not be employed for our data set. The Hausman test is the classical test for the appropriateness of random effects methods. This test involves comparing the covariance matrix of the least squares dummy variable model with that of the random effects model. The test is for correlation between the unobserved country specific random effects and the regressors. If such correlation exists, the random effects model is not chosen and the first differences or the fixed effects model is appropriate. If the correlation is insignificant, then random effects methods can be applied. This is a Wald type test distributed as χ^2 with degrees of freedom equal to $k-1$ (where k = number of regressors). The value of χ^2 in our case is 22.48, with p-value less than 0.01. Thus the null hypothesis of no correlation is rejected, and therefore, the random effects method is to be considered inappropriate.

SUMMARY

The estimations for the full sample yield results generally consistent and supportive of the gravity model of trade. Specifically, we obtain estimates of elasticities of trade with respect to exporter and importer GDPs consistent with previous results. In the regressions in which distance appears, its sign is appropriate and its elasticity is consistent with other work. We do not find, in the appropriate estimations, important effects of either the FTA or currency volatility.

One interesting finding in these estimations was that of the 1368 total observations, only 1335 observations could be used, that is, 33 observations were zero (the logarithm of zero is undefined). This occurs for two reasons: the data was missing or the trade level between those two countries for the given years was indeed zero. The statistical program skipped those observations for the estimations.

RESULTS OF AN EXPERIMENT FOR CHINA

The following results attempts to estimates the effects of various trade determinants on level of trade between China and a subset of its eight selected trading partners in our original dataset. The methods employed here are the same four regression analyses (OLS, FD, FE, RE) used for the full dataset. We have 152 total observations, and they are all usable.

Ordinary Least Squares

In this regression, each explanatory variable is statistically significant and the equation has a high degree of explanatory power ($\bar{R}^2 = .9199$). However, there are two reasons which indicate OLS is not an appropriate method here. First, notice that the coefficient for distance is statistically significant but “wrong” signed, it’s not reasonable to say that China tend to trade more with countries which are farther away, this is counter to economic theories. Second, a simple test similar to the one for the full sample which will indicate whether individual effects exist is employed here, and thus determine the appropriateness of ordinary least squares. This test augments equation (1) by adding $i - 1$ dummy variables ($D_1, D_2, D_3, D_4, D_5, D_6$) in order to test for individual effects as follows:

$$\log(X_{ij}) = \beta_0 + \beta_1 \log(\text{GDP}_{E_t}) + \beta_2 \log(\text{GDP}_{I_t}) + \beta_3 (\text{VARE}_{it}) + \beta_4 \log(\text{DIST}_{ij}) + \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3 + \alpha_4 D_4 + \alpha_5 D_5 + \alpha_6 D_6 + \varepsilon_{it}, \quad (2')$$

From (2') we test that the α_i coefficients are jointly zero, i.e.,

$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$ (there are no country effects)

$H_1: \text{some } \alpha_i \neq 0$ (one or more country effects are present)

The F-test returns a value of 434.85, indicating that the α_i are (very) significantly different from zero, thus rejecting OLS as an appropriate method for this panel data set.

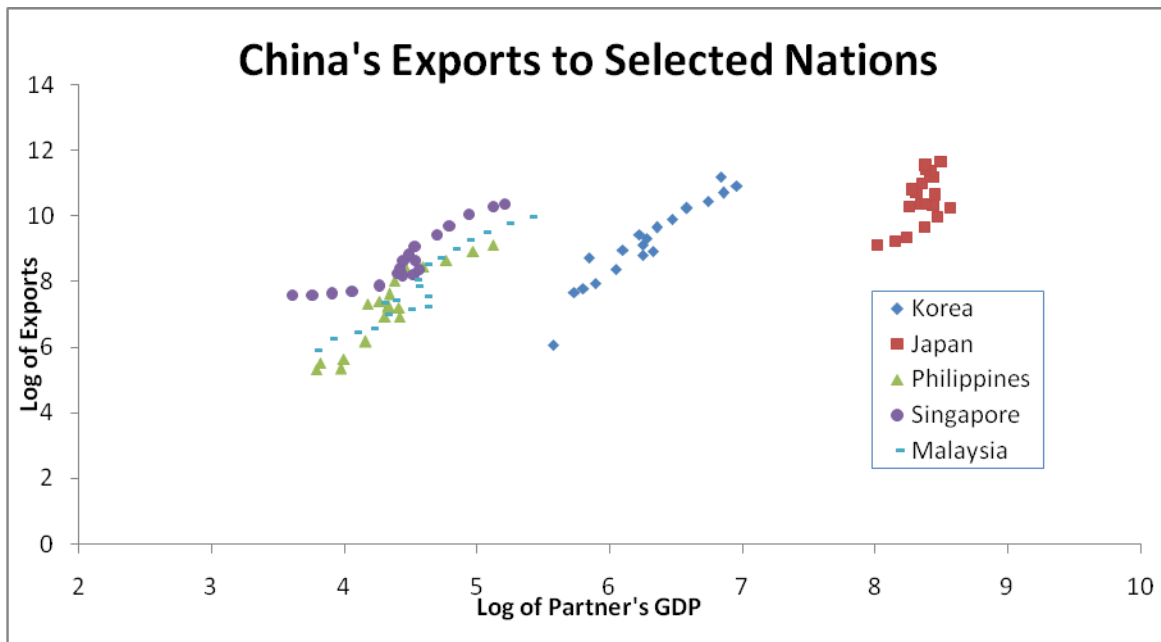
Table 2 contains the results of the estimations for each of the four methods of estimation for China.

Table 2: Alternative Gravity Model Estimations (China)				
Explanatory Variable	Ordinary Least Squares	First Differences	Fixed Effects	Random Effects
Constant	-6.451 (-5.97)	----	----	-11.327 (-1.79)
Total China GDP	1.151 (16.12)	1.032 (4.92)	0.945 (11.83)	0.997 (13.65)
Total Foreign GDP	0.855 (31.13)	0.825 (4.62)	1.248 (10.70)	1.151 (11.44)
Currency Volatility	-0.046 (-2.79)	-0.005 (-0.46)	-0.032 (-2.44)	-0.034 (-2.65)
Distance	0.272 (2.29)	----	----	0.853 (1.07)
\bar{R}^2	0.9199	0.0778	0.9599	
SEE	0.6009	0.3292	0.4251	0.4174

(t-statistics in parentheses below parameter estimates.)

Figure 1 is created as an example to show China exports to each China trade partner (five countries were selected) as a function of the GDP of the partners. Examination of Figure 1 gives some visual appreciation of some of the issues above. Two aspects of that graph are relevant to the analysis above and choice of method. First notice that the individual series would have

differing intercepts (otherwise each series would appear “on top of” the others). Second the assumption of equal slopes (for the foreign GDP variable) does not appear to be reasonable, though the series for Japan may have a somewhat greater slope.



First Differences

Here we find China and foreign GDP to be statistically significant in explaining total China trade. Exchange rate volatility also is not a statistically important explanatory variable in the first differences regression. Note that China doesn't have FTA with any of its trading partners in our dataset. The explanatory power of this regression is the lowest among all the four methods ($\bar{R}^2 = .0778$), as expected.

Fixed Effects

The fixed effects method finds highly significant effects for China GDP and foreign GDP. Currency volatility has statistically important but weak effects on China trade. That is, the more fluctuations between Yuan and foreign currencies, the less trade China would have with these countries. The explanatory power of this regression is high ($\bar{R}^2 = .9599$).

Random Effects

The random effects method yields estimates for the coefficients of variables that are very similar to those in the fixed effects model. For the additional variable included in the RE estimation, we find distance to be statistically insignificant, but currency volatility is correctly signed and statistically significant. In addition, Hausman test indicates that random effects regression can be

employed for our data set. The value of χ^2 in our case is 2.94, with p-value of 0.4 (much greater than 0.1). The random effects method is to be considered appropriate here.

DISCUSSION

We find that the total GDP of both the export country and the import country to be statistically significant across all estimations; this is congruent with earlier studies. In addition, we find that the GDP of the importer has larger effects than that of the exporter in determining one country's export to another. In the fixed effects model, which we consider to be the most appropriate model here, the coefficient of the total exporter GDP is 0.722 (see Table 1), while the coefficient of the total importer GDP is 1.13. This means, for example, when the export country *i*'s GDP increases by 10%, its export to *j* will increase by 7.22%; when the importer *j*'s GDP grows by 10%, its imports from *j* (*i*'s export to *j*) grows by 13%. This phenomenon can easily be explained. As country *i*'s economy gets bigger, it produces more goods or services (GDP grows), so country *i* is able to export more to country *j*, but this alone does not determine exports. More importantly, whether country *i* could sell the extra goods or services produced depends on the change of demand of country *j*. If country *j*'s economy also grows, this creates more demands of goods and services, including those produced by country *i*. Therefore, export from *i* to *j* increases.

We find that bilateral currency volatility is not a statistically significant determinant of trade for the panel of nine Asian nations. This is different from some prior work. However, we find from the experiment for China that currency volatility to be statistically significant, and has negative effects on China exports to other countries as we anticipated, though the effects are somewhat weak. To find more information about the significance of currency volatility, we also ran identical experiments for other countries. Interestingly, it turns out that currency volatility is significant for none of the other Asian countries. As an example, Table 3 shows the results of the experiment for Japan, currency volatility is not significant in all the four models (Hausman tests were passed for all the countries).

This finding is important and reasonable. All the nine selected countries have a floating exchange rate system, except for China, whose currency (the RMB) was fixed with the US dollar before 2005 and then switched to a managed floating exchange rate system. Now RMB foreign exchange rates are based on market supply and demand with reference to a basket of foreign currencies, including US dollar, Euro, Japanese yen and South Korean won, British pound, Thai baht, Russian ruble, Australian dollar, Canadian dollar and Singapore dollar. A managed floating exchange rate system allows the RMB to float relatively more freely. Since the period under research is from 1990 to 2008, for fifteen years out of the total nineteen years, yuan was fixed against US dollar and therefore floated against all the other foreign currencies. Therefore, the currency volatility maybe considered significant when determining trade levels for China. China may trade less with certain countries if the bilateral currency volatilities are high.

Another finding is that the variable for distance is not statistically important, this is supported by random effects results from individual experiments for all the selected countries (Hausman tests were passed for all the countries as mentioned above), with the exception of Thailand. This finding is consistent with recent research which indicate that distance is becoming less of a factor

in determining trade flows due to more efficient and low-cost communication technology and transportation methods. It's also important to know that the second reason here maybe the target countries are all Asian countries (not very widely spread), particularly those 6 ASEAN member countries (Malaysia, Singapore, Indonesia, Thailand, Cambodia and Vietnam) are small countries located so closely to each other that most of them have some contiguous borders. However, there is no good economic reason that can explain why distance seems to matter so much to Thailand, the absolute value of the coefficient of distance is high (4.649).

Table 3: Alternative Gravity Model Estimations (Japan)				
Explanatory Variable	Ordinary Least Squares	First Differences	Fixed Effects	Random Effects
Constant	-1.866 (-0.49)	----	----	-3.104 (-0.58)
Total Japan GDP	-0.472 (-1.06)	0.999 (-2.85)	0.624 (-2.43)	0.556 (-2.21)
Total Foreign GDP	1.263 (-31.49)	0.558 (-3.14)	0.878 (-14.35)	0.905 (-15.43)
Currency Volatility	-0.017 (-0.31)	-0.013 (-0.5)	0.021 (-0.76)	0.024 (-0.87)
Distance	1.086 (-8.04)	----	----	0.378 (-0.59)
\bar{R}^2	0.8977	0.1202	0.9768	
SEE	0.6671	0.3452	0.3179	2.0862

(t-statistics in parentheses below parameter estimates.)

According to what we found from ASEAN Secretariat, since AFTA was established, the amount of total trade among member countries has grown from \$44.2 billion in 1993 to \$1521.28 billion in 2009, Intra-ASEAN trade made up 24.2% of total ASEAN trade in 2009. In addition, prior studies on AFTA and ASEAN also suggest the formation of AFTA has indeed resulted in trade creation among its members. However, those positive effects of AFTA are not captured in our study. The fixed effects results show that t-statistics for FTA is only -0.28 (see table 1), which means FTA is not a statistically significant variable in determining bilateral trade among these nine countries at all. However, according to economic theory, as the trade barriers such as tariffs, quota are reduced or removed because of the FTA, trade volume should grow.

Two possible reasons can explain these results: (1) The three countries outside of AFTA, namely China, Japan and Korea are all leading trading countries with much bigger economies than those ASEAN member countries, therefore, the trade growth induced by AFTA maybe too little to be captured in the regression models. (2) AFTA first started in 1993, our study period starts from 1990, this means except for Vietnam and Cambodia which joined AFTA in mid 1990s, every other member country has 0 for dummy variables before 1993 (three zeros) and 1 for dummy variables since 1993 (sixteen ones). China, Japan and Korea have 0 for dummy variables through all the years. This means that, in general, the variation of FTA dummy variable over 19 years does exist, but it has little variation. Remember that explanatory variables that do not change over time would be dropped out of the estimation equation. Here FTA still has minor changes over time so it can still be included for estimation equation, but it becomes statistically insignificant.

It's also important to notice that tariff reduction in FTA does not happen all at one time (say reduces from 15% to 0% in a one year period), it is divided into several phases (say reduces from 15% to 12% in the first year, 10% in the second year, 8% in the third year and gradually reduce to a satisfied level). So it's reasonable to assume that the effects of FTA becomes increasingly important over time. To capture this, we can make the value of the dummy variable 1 for the year the country enters FTA, and increase it by 1 for each additional year, instead of making it carry the unit value for all the years that FTA are on. For example, Vietnam entered AFTA in 1995, then the value of the dummy variable should be 1 for the year 1995, 2 for 1996, 3 for 1997, etc. However, the results we got under this assumption still shows that FTA has no statistically significant effect on bilateral trade between those countries (the t-statistics for FTA is only 1.22, the coefficient of 0.008).

From the study of previous research, we found that it's controversial whether population should be included in the gravity model as a variable which also determines trade. This is because the sign (positive effects or negative effects) of population turns out to be ambiguous in these studies. Even though we decided not to include population in our estimation after running several tests for population variable, the results are very interesting. According to the estimation of fixed effects model, neither exporter population nor importer population is significant, but they both have positive estimated coefficients. While both exporter population and importer population are highly significant in Ordinary Least Square model, but they both have negative effects on trade. Though we know OLS is not an appropriate model for our study, we can still see how population, unlike other variables, gets very different estimations in various regression methods.

We also ran experiments to find population effects on all individual countries export to other selected countries. The result (see table 4) we find is consistent with a few earlier studies: the exporter population is significant and positively related to trade for every country (excluding Cambodia and Vietnam). However, the impact of the importer population is uncertain; we find that the importer population has negative effects on trade for all countries (except for Philippines), but the significance level varies among countries. We find one explanation for this phenomenon: as the exporter population gets bigger, it's certain that it will be able to produce more goods and services to export to other countries; however, as the importer population increases, two outcomes have to be taken into consideration. The first is that the import

country will be able to produce more goods or services on its own, so the demand for imports declines. The second is that, as the population grows the import country's demand for goods or services from other nations also grows. Therefore, whether the population change of the import country is significant or not may depends on which effect overweighs the other.

Table 4: Population Estimates									
	China	Japan	Korea	Thailand	Vietnam	Philippines	Singapore	Cambodia	Malaysia
lnpop_X	10.933	10.694	6.293	4.579	6.895	8.045	1.376	4.315	1.994
	(2.72)	(2.01)	(3.86)	(3.87)	(1.69)	(7.97)	(2.94)	(1.90)	(3.05)
lnpop_M	-0.688	-2.074	-1.075	-0.564	-0.245	0.544	-0.972	-1.091	-0.899
	(-1.72)	(-3.86)	(-2.41)	(-1.26)	(-0.64)	(-0.79)	(-2.28)	(-0.93)	(-1.74)

CONCLUSION

This project succeeded in producing results in line with previous gravity model studies of international trade. With bilateral exports between any of the two selected Asian countries serving as our dependent variable, we offer results from four estimated models: Ordinary Least Squared (OLS), and three specialized panel methods, First Differences (FD), Fixed Effects (FE), and Random Effects (RE). We find that the GDP of the export country and import country to be important determinants of bilateral trade. We also find that the effects of distance does exist, but turn out to be very weak as anticipated. Currency exchange rate is significant and has negative effects only for China's trade with other nations. Surprisingly, we find the formation of AFTA doesn't have a significant impact in increasing the AFTA member countries' trade. This result contradicts with the trade statistics provided by ASEAN Secretariat and some ealier researches. Finally, in our test for population variable, we find the exporter population to be significant and has positive effects on trade for every country except for Cambodia and Vietnam; while the importer population has negative effects on trade for all countries (except for Philippines), but the significance level varies among countries. This result, to some extent, explains why economists are not in agreement as to whether population varible should be included in the gravity model for trade.

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APPENDIX

Panel Methods Description

Panel data have both a cross section (say different nations) and a time (say different years) dimension. For example, suppose we have trade data on 10 nations and over two years. The years need not be consecutive, i.e., suppose the first year of data are for 2000 and the second year of data are for 2010. Suppose we measure exports from the US to 10 other nations and we assume exports depend on the GDP for the foreign (other than US) nation. $GDPF_{it}$ represents GDP of the foreign nation for a particular year, hence i refers to the nation, and t references the year.

$$Exports_{it} = \beta_0 + \beta_1(GDPF_{it}) + \varepsilon_{it} \quad (1)$$

There are likely to be factors that affect trade not accounted for in the equation. For example, the US might trade more with the UK than with other nations because of similar tastes. There may also be unobserved effects that vary over time as well. Suppose we begin to trade more with some nation that is not in our data set, so we trade less with the nations *in* the data set. Or time trends in the data cause more trade with all nations, for reasons not captured by our explanatory variable(s).

So we now write the regression as:

$$Y_{it} = \beta_0 + \delta_0 d2_t + a_i + \beta_1(X_{it}) + \varepsilon_{it} \quad (2)$$

Where $d2_t$ = a dummy variable, $d2_t = 0$, in the first year of data (2000), and $d2_t = 1$ for the second year of data (2010), so that $d2_t$ represents the unobserved time effects. The effect of $d2_t$ is (of course) to shift the intercept for the second year of data (in 2010 the intercept would be $\beta_0 + \delta_0$). Note importantly that $d2_t$ does not vary across nations in the data set, so it does not have an “ i ” subscript. (This means that the time effect would be shared the same across nations.)

a_i = the unobserved country effects.

a_i is not expected to vary over time, so in our example we would maintain our preferences for UK goods over time.

Four different panel regression methods were employed in this project:

I. Ordinary Least Square (OLS)

OLS minimizes the sum of squared residuals, a residual is the difference (error) between an observed value and the estimation. When we estimate using OLS, write the equation as:

$$Y_{it} = \beta_0 + \delta_0 d2_t + \beta_1(X_{it}) + v_{it} \quad (3)$$

Note that we include $d2_t$ dummy variable in this equation, since the time effects can easily be measured. However, we cannot measure country effects such as tastes - a_i , then we have left-out

variable bias because a_i is not in the equation. Only in the case where a_i has no effect is OLS an appropriate procedure.

II. First Differences (FD)

Suppose we define:

$$\text{Year 2 (2010): } Y_{i2} = \beta_0 + \delta_o + a_i + \beta_1(X_{i2}) + \mu_{i2} \quad (4)$$

$$\text{Year 1 (2000): } Y_{i1} = \beta_0 + a_i + \beta_1(X_{i1}) + \mu_{i1} \quad (5)$$

Now subtract (5) from (4):

$$(Y_{i2} - Y_{i1}) = \delta_o + \beta_1(X_{i2} - X_{i1}) + (\mu_{i2} - \mu_{i1}) \quad (7)$$

Or

$$\Delta Y_{it} = \delta_o + \beta_1 \Delta X_{it} + \Delta \mu_{it} \quad (7')$$

This is called differencing. Notice that unobserved country effects a_i is eliminated through the differencing procedure in (7) so there is no left-out variable bias. For the presumed model, the left-hand side of (7) is the change in trade between 2000 and 2010, and the right-hand side consists of the change in the intercept between 2000 and 2010 (δ_o), and the change in GDP for each nation. The big drawback is that variables associated with specific countries that do not change over time (distance, common language, FTAs⁵ cannot be included in the explanatory variable set, since they will drop out of the equation.

III. Fixed Effects (FE)

Fixed effects regression is the model to use when you want to control for omitted variables that differ between cases but are constant over time. It lets you use the changes in the variables over time to estimate the effects of the independent variables on your dependent variable. The fixed effects model involves “de-meaning” the data. Suppose we have the general equation:

$$Y_{it} = \beta_0 + \beta_1(X_{it}) + a_i + \varepsilon_{it} \quad (8)$$

Now average the equation across time, so we have

$$\bar{Y}_i = \beta_0 + \beta_1 \bar{X}_i + a_i + \bar{\varepsilon}_i \quad (9)$$

Subtract 12 from 11, which yields

$$Y_{it} - \bar{Y}_i = \beta_1 (X_{it} - \bar{X}_i) + \varepsilon_{it} - \bar{\varepsilon}_i$$

⁵ If the FTA begins during the time period, then it can enter as an explanatory variable.

Now let

$$\begin{aligned}\tilde{Y}_{it} &= Y_{it} - \bar{Y}_i, \\ \tilde{X}_{it} &= X_{it} - \bar{X}_i \\ \tilde{\varepsilon}_{it} &= \varepsilon_{it} - \bar{\varepsilon}_i\end{aligned}$$

We can now write:

$$\tilde{Y}_{it} = \beta_1 \tilde{X}_{it} + \tilde{\varepsilon}_{it} \quad (10)$$

The function of FE is similar to FD, the unobserved fixed effect, a_i , is eliminated (as well as the intercept). Unfortunately, country specific effects that do not vary over time (distance, common language, contiguous borders) are again eliminated through the de-meaning process. So we need methods than *can* estimate the effects of distance, common language, FTAs, and the like for gravity models of trade.

IV. Random Effects (RE)

If we can believe that a_i is uncorrelated with each explanatory variable in all time periods (in addition to the fixed effect model assumptions), we can derive “random effects” estimation from equation (10):

$$Y_{it} - \lambda \bar{Y}_i = \beta_1 (X_{it} - \lambda \bar{X}_i) + \varepsilon_{it} - \lambda \bar{\varepsilon}_i \quad (11)$$

Where λ is estimated simultaneously with the other parameters (using MLE methods) and the data are transformed accordingly. Since λ is always between 0 and 1, the data are referred to as quasi-demeaned. Notice that variables that do not change over time are *not* differenced or demeaned away in this formulation. Thus many of the variables of interest can be included in the analysis. Note also that if $\lambda = 0$, the random effects estimation is simply OLS, and if $\lambda = 1$, random effects estimation is the same as fixed effects.

The problem with random effects estimation is that the parameter estimates are inconsistent if the a_i are correlated with any of the explanatory variables. There is a Hausman (1978) test that compares the estimates of the FE and RE, indirectly testing the assumption that the a_i are uncorrelated with any of the explanatory variables

**REMANUFACTURING SCHEDULING:
A SYSTEMATIC LITERATURE REVIEW AND ANALYSIS**

ABSTRACT

We examine our progress in scheduling remanufacturing operations by reviewing the literature in detail. We individually examine published research in scheduling disassembly, remanufacturing/repair, and reassembly operations and their integration. The objective functions/performance criteria, quantitative methodologies, and complexities/issues are examined. Finally, an overall assessment of our progress and continued research needs are presented.

1. INTRODUCTION

Sustainable practices are gaining in importance as a competitive strategy in today's business climate. The "take – make – waste" system (Duta et al., 2008) is no longer sustainable given a heightened understanding of finite resources and landfill space coupled with growing world populations and their consumption of industrial goods. As a result, producers that rapidly discover and/or adopt ways to manufacture using a life cycle approach increase their potential for product differentiation, customer loyalty and profitability.

Remanufacturing is a life cycle strategy that allows products that are no longer functional to re-enter the manufacturing process to be refurbished or disassembled into usable modules, components or materials, or disposed. Remanufacturing in the U.S. is a \$53 billion industry (Giuntini and Gaudette 2003). This reprocessing can significantly reduce the amount of waste directed at landfills and conserve natural resources involved in product development. This is particularly important for manufacturers facing increasing pressure to produce products in an environmentally supportive manner. According to Carter and Ellram (1998), over \$124 billion is spent in the United States to comply with mounting environmental statutes and regulations and this undoubtedly will escalate.

The concepts associated with remanufacturing are not new. Remanufacturing received academic attention at MIT's Center for Policy Alternatives as early as 1979 (Lund 1984) and published reports of industrial applications of remanufacturing/recycling in the automobile industry emerged in the early 1990's (e.g., Wolfe 1991, Stix 1992, Anon 1993). The enormous complexity of remanufacturing has attracted significant research efforts focused on developing effective and efficient remanufacturing operations. They are arguably more difficult than designing and managing forward supply chains, since forecasting the timing and quality of product returns and determining the optimal disassembly sequence(s), as examples, are so problematic (Toktay 2003). Guide (2000) outlines the characteristics that significantly complicate the production planning and control activities involved in remanufacturing: (1) the uncertain timing and quantity of returns, (2) the need to balance returns with demands, (3) the disassembly of returned products, (4) the uncertainty in materials recovered from returned items, (5) the requirement for a reverse logistics network, (6) the complication of material matching restrictions, (7) the

stochastic routings for materials for remanufacturing operations, and (8) highly variable processing times. Other researchers (e.g., Krupp, 1993; Brennan, Gupta, and Taleb, 1994; Flapper et al., 2002; and Kim et. al., 2007) have noted other significant challenges, issues, and decisions involving remanufacturing scheduling, such as the selection of order release mechanisms, lot sizes, and priority scheduling rules; capacity restrictions; part commonality among multiple products; the planning of buffer inventories; scheduling over multiple time periods; integration of forward and reverse manufacturing operations, etc.

Guide (2000) describes a typical remanufacturing facility to consist of three distinct operations: (1) disassembly, (2) remanufacturing/repair, and (3) reassembly. Disassembly separates the returned item into its modules, components, or basic materials. These are evaluated and determined to be acceptable for reuse, repairable, sold for scrap, or discarded. Those modules and components needing repair or rework are inventoried for later recall or sent to the remanufacturing/repair operations. After reconditioning to a usable state the modules or parts are inventoried awaiting use or sent directly to the reassembly processes, where they are reassembled into products for resale and readied for finished goods inventory or shipment. As emphasized by the complicating characteristics, the scheduling and control of each of these operations is an extremely challenging task.

However, progress has been made in identifying the realistic complexities and issues in remanufacturing scheduling needing address and developing numerous quantitative methodologies and testing various objective criteria to achieve improved, if not optimal, solutions. Numerous articles have been published and research projects completed on these subjects; the review article by Gungor and Gupta (2008) alone contains over 540 references and provides a holistic view of product life cycle considerations. However for the practitioner and academic researcher focused on advancing a specific area within product life cycle management, review articles matching this focus are necessary to summarize and analyze current knowledge and to highlight areas needing further exploration. Thus, the purpose of this research effort can be divided into three stages : (1) review the progress we have made in the scheduling of disassembly and remanufacturing operations; (2) assess how we have advanced our ability to address the scheduling complexities mentioned in the literature; and (3) highlight additional research needs. We know of no other research that has reviewed in detail the disassembly scheduling and remanufacturing literature and the complexities/issues that impact this environment. Figure 1 delineates the

boundaries of our research effort, which includes the three remanufacturing operations and the buffer inventory considerations.

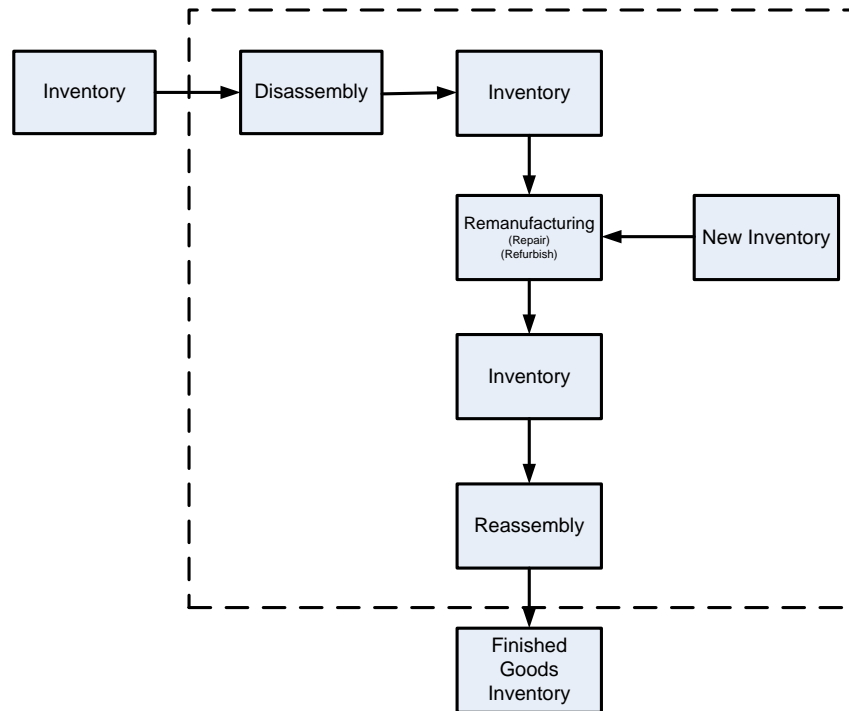


Figure 1: Remanufacturing Shop

Our literature analysis is organized in a strategic-to-tactical decision framework (product decisions before process decisions, etc.) supplemented by the necessary technological and operational progressions that need to be made in the disassembly environment. Section 2 details our research methodology including the research questions, the scope of the literature search, the publication selection criteria, publication quality assessment, data extraction, and the data synthesis and aggregation. We devote Section 3 to a review and analysis of the single and multiple product disassembly literature. We further subdivide this literature into infinite versus finite capacity, no part commonality to part commonality, and the use of deterministic versus stochastic parameters. Using the same organizational structure Section 4 reviews the literature that integrates the scheduling/planning of remanufacturing disassembly, remanufacturing and/or assembly. Section 5 investigates the uncertainty and stochasticity challenges facing remanufacturing and the progress made. Section 6 discusses the objective criteria/functions and

methodologies used in remanufacturing scheduling. Section 7 summarizes our findings and our analysis of research efforts. Finally, section 8 characterizes future research needs.

2. REVIEW METHODOLOGY

In this study, our aim is to summarize, analyze, and synthesize what we know about remanufacturing scheduling. The main research questions addressed in this study are:

- Q1: What classification would be useful in organizing our research into remanufacturing scheduling and aid researching our progress?
- Q2: What progress have we made in remanufacturing scheduling?
- Q3: Specifically, what complexities have been addressed and which remain to be explored?
- Q4: What objectives have been explored in remanufacturing scheduling?
- Q5: What methodologies have been employed and which appear to have the most promise?

With Q1 we aim to disseminate our understanding of the current state of remanufacturing scheduling through a useful classification of the selected published works which identify themes and problem characteristics successfully tackled by researchers. Answering Q2 allows us to identify the current state-of-the-art in remanufacturing scheduling. Our aim is to understand those topics in remanufacturing scheduling receiving the most attention and those areas that need further exploration. Our organization of the remanufacturing scheduling literature and progress in scheduling is addressed in sections 3 and 4 of this paper.

As presented earlier, Guide (2000) outlines several issues that complicate remanufacturing scheduling as a direct result of the uncertainty of such a system. Through Q3, we seek to characterize advancements and needs in managing uncertainty in this environment. Complexities such as stochasticity and uncertainty and our progress in addressing them will be discussed throughout sections 3 and 4 and specifically in section 5.

The objective of scheduling is to optimize the productivity of a process through the effective use of resources. With Q4, we seek to understand the objective criteria employed to meet production schedules and capacity considerations. This will be reported in the first part of section 6 of the paper.

The ability to employ effective scheduling methodologies across the full range of remanufacturing scheduling activities (i.e., disassembly, remanufacturing/ repair, and re-assembly) is tremendously complex. Through Q5, we will analyze and report on the existing methodologies used in remanufacturing scheduling and

discuss their promise for use in industrial settings. The latter portion of section 6 will present our findings on problem formulations and solution methodologies.

2.1 Search Scope

Research papers considered for inclusion in our systematic literature review must be (1) written in English, (2) published prior to July 2010, (3) from a peer reviewed journal or conference proceedings, and (4) accessible through electronic management databases.

2.2 Search Process

In consultation with a reference librarian with expertise in searching business, science, and engineering databases, we established a search string and a list of relevant databases pertaining to our topic. Three electronic databases (ScienceDirect, ProQuest, and EBSCOhost) were utilized in the search process. For each electronic database search, we used a search string semantically equivalent to the following:

((disassembly AND scheduling) OR (remanufacturing AND scheduling))

Further collaboration with the librarian resulted in additional refinement of our search process by the omission of irrelevant sub-databases. Trial tests demonstrate that the omission of unrelated sub-databases did not produce articles for inclusion in our literature analysis. In the paragraphs to follow we describe our electronic database search in more detail.

In ScienceDirect, the expert search function is used to identify peer-reviewed academic journal articles in the subject areas of: (1) business, management, and accounting, (2) decision sciences, (3) economics, econometrics, and finance, (4) engineering, and (5) environmental science. The results of this search produced a list of 512 articles.

ProQuest is a large repository of numerous searchable digital databases. To increase the probability of retrieving relevant articles from ProQuest, four sub-databases (ABI/INFORM Dateline, ABI/INFORM Global, ABI/INFORM Trade & Industry, and ProQuest Asian Business and Reference) were selected. After the elimination of duplicates, a total of 55 articles were identified for further review.

Finally, seven databases (Academic Search Premier, Business Source Complete, Business Source Premier, EconLit, GreenFILE, Military and Government Collection, and Science Reference Center) were selected with EBSCOhost for relevant article retrieval. Forty-one unduplicated articles were identified. Our electronic searches were augmented by scanning the bibliographies of articles marked for inclusion as well as review articles (e.g., grey literature). In the next section we discuss the criteria for inclusion and exclusion.

2.3 Selection criteria

The resulting titles of the articles and abstracts (N = 608) were reviewed by both authors to assess each article based on the inclusion and exclusion criteria below. Articles were assigned a corresponding exclusion or inclusion code (see below). Articles assigned differing codes by the authors or those labeled ‘undecided’ were resolved through discussion. An article was excluded if the focus was primarily exploring:

- E1. Disassembly sequence or process planning (how to take an end item apart while adhering to precedence relationships)
- E2. Production or aggregate planning
- E3. Process planning and design (line balancing, work design, facility planning)
- E4. Inventory control policies
- E5. Demand acquisition (strategies for forecasting or controlling the acquisition of end-of-life products (i.e., cores)).
- E6. Review articles were excluded but the contents and reference lists were reviewed.
- E7. Miscellaneous topics – remanufacturing profitability, motivation, reverse logistics, network design, scheduling unrelated to remanufacturing, and transportation planning and scheduling

An article was included, if it dealt with one or more of the topics listed below within the context of remanufacturing scheduling.

- I1. Disassembly operations scheduling
- I2. Integrated operations scheduling processes for remanufacturing scheduling
- I3. Lot size techniques and considerations (determining the quantity to order for production)
- I4. Buffer inventory if associated with scheduling and scheduling performance
- I5. Rule-based dispatching or sequencing strategies in remanufacturing scheduling (how are jobs sequenced through different work centers?)
- I6. Other topics that can impact remanufacturing scheduling performance such as disassembly release mechanisms, lead time variations, and product structure complexity

Figure 2 illustrates the process of the systematic review.

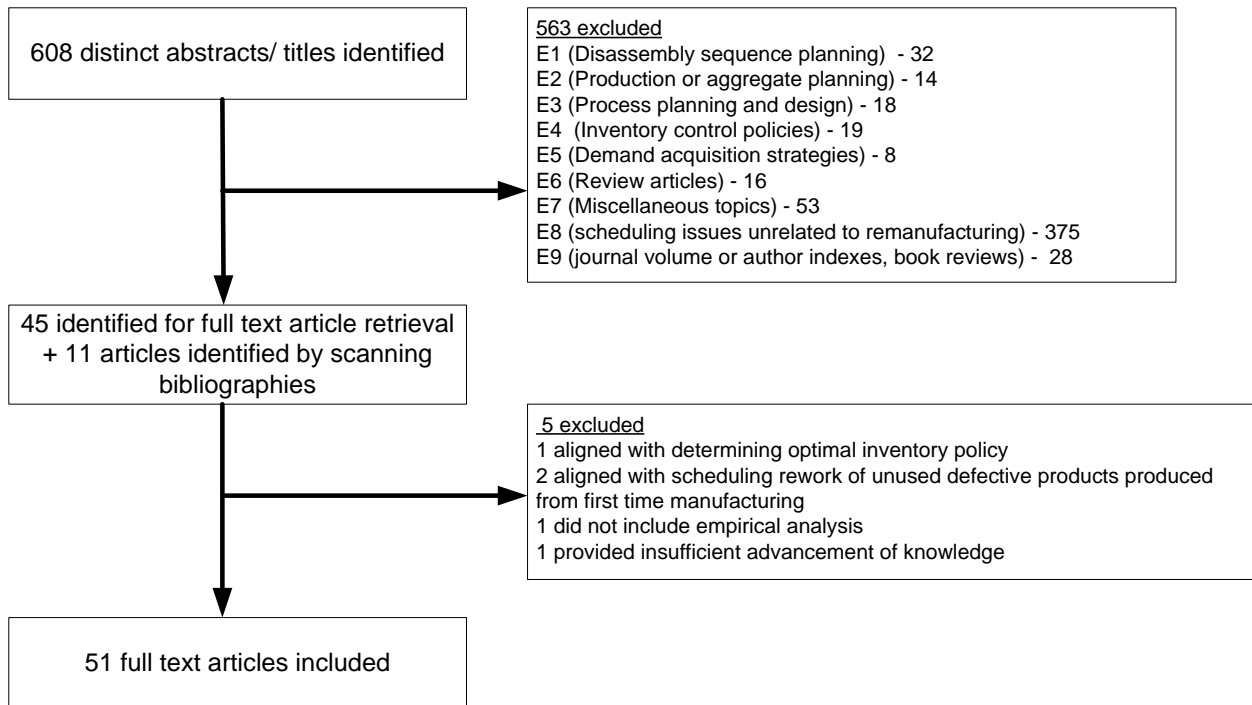


Figure 2: Systematic Review Process

2.4 Quality Check

The quality assessment aims to ensure that the methodologies and results of the primary studies included in our literature analysis are valid. All of the articles are from reputable journals and conference proceedings that adhere to a rigorous peer review protocol. An additional characterization of each article's quality is determined by answers to a set of questions (see below). A binary (yes/no) schema is used to answer each question. The quality assessment was performed by both authors and questions were resolved through discussion.

- Q1. Does the paper identify a major remanufacturing scheduling problem or issue?
- Q2. Does the paper identify and illustrate how a characteristic can affect scheduling effectiveness (disassembly release mechanisms, buffer inventory locations and amounts, priority scheduling rules, lot sizing, scheduling accelerator rules, etc.)?
- Q3. Does the paper develop and illustrate a new, relevant objective function?
- Q4. Does the paper incorporate additional modeling complexity(ies) previously addressed?
- Q5. Does the paper extend the methodology, objective, and/ or complexity(ies) from single to multiple products?
- Q6. Does the paper extend the methodology, objective, and/or complexity(ies) from infinite capacity to finite capacity?
- Q7. Does the paper extend the methodology, objective, and/ or complexity(ies) from no part commonality to part commonality?

- Q8. Does the paper report on test results comparing the advantages and disadvantages of various solution methodologies and/or objective criteria?
- Q9. Does the paper develop or model a stochastic characteristic not previously addressed or addressed in deterministic form?

2.5 Data Extraction

The selected studies were read in depth in order to extract the information/data needed to answer the research questions. Both authors read the selected papers in parallel. Data were extracted from the literature based on a detailed set of categorizations. These categorizations are listed as table headings and include the operations focus, production strategy, product, process and work-related features, the performance measurement or objective criteria used, and the quantitative methodology employed.

2.6 Data Synthesis and Aggregation

The remanufacturing scheduling literature was categorized by constructing the single/multiple product, commonality/no commonality, infinite capacity/finite capacity, deterministic/stochastic parameters organizational structures (see Figure 4, 6, 7, and 8). For the integrated scheduling section we also chose to organize the results by the same classification augmented, for clarity, with topical interventions. Table 1 is dedicated to summarizing and assisting in the analysis of the research addressing the uncertainty and stochasticity incumbent to remanufacturing. Finally, Table 2 lists the articles reviewed and important characteristics of each. Thus, these structural and tabular forms were used to: (1) organize, visualize, analyze, and summarize the important elements of the remanufacturing scheduling research; (2) help address the five research questions posed; and (3) support the conclusions provided.

3. SCHEDULING DISASSEMBLY OPERATIONS

We first characterize the disassembly structure and the important nomenclature of the problem environment. The root item is the product to be disassembled. A leaf item cannot be disassembled further and are the items to satisfy demand. In Figure 3, item 1 represents the root and items 4, 5, 6, and 7 are leaf items. A child is defined as any item that has at least one parent and a parent has at least one child. Referring to Figure 3, item 3 is a parent to child items 6 and 7. Numbers in parentheses represent the item yield when the parent item is

disassembled. Thus, when item 2 is disassembled it yields four units of item 5. From this, we define the basic disassembly problem as follows:

For a given disassembly structure, determine the quantity and timing of disassembling all parent items (including the root item) while satisfying the demand of leaf items over a given planning horizon with discrete time periods (Kim et al., 2007).

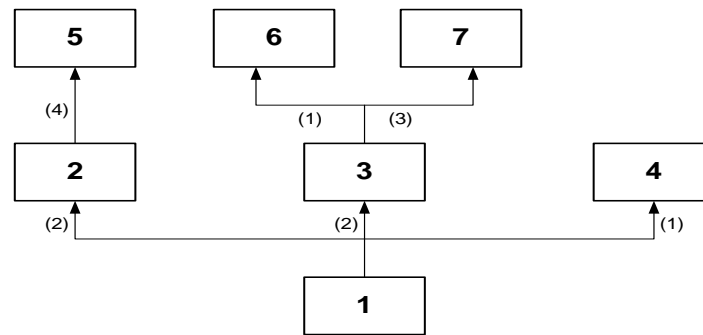


Figure 3: Disassembly Structure/ No Commonality

3.1 Disassembly Operations for Single Products

Much of the work that addresses the single product disassembly scheduling problem assumes infinite capacity. That is, no limitations on resources (e.g., setup time, equipment, and storage). Articles that investigate the infinite capacity, single product environment can be further classified according to whether part commonality is considered. Part commonality adds considerable complexity to the disassembly scheduling problem since there are multiple procurement sources for demand items. Figure 4 summarizes the research efforts for scheduling disassembly operations for single products.

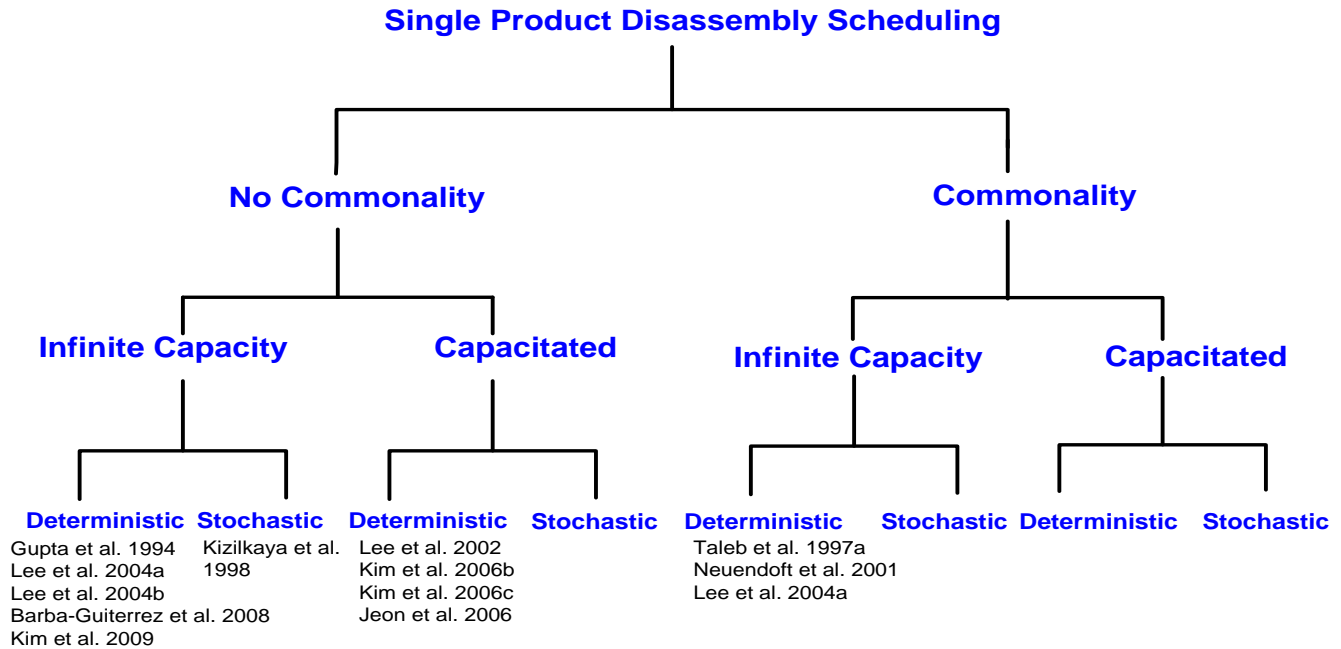


Figure 4: Disassembly Scheduling Research for Single Products

3.1.1 No Part Commonality with Infinite Capacity

A total of six articles are within this classification; five are deterministic and one incorporates stochastic features. Gupta and Taleb (GT, 1994) define the disassembly scheduling problem and develop a reverse MRP procedure (RMRP) with no explicit objective function – merely satisfy demand for all leaf items. Their MRP-like procedure is a logical starting point given the widespread use of material requirements planning (MRP) in practice for OEM production planning. A major pitfall in applying MRP-like methodologies in disassembly scheduling is the difficulty in handling the divergence of a product into multiple demand sources of parts/components.

Ten years lapse before researchers specifically address the shortcomings of the GT procedure by using mathematical programming methods that incorporate cost-based objective functions. Lee and his colleagues (Lee et al., 2004a) develop and solve an integer programming model which performs well for medium-sized problems. Hereafter, heuristics are used to overcome the computational burden for large-sized problems or to handle additional problem complexities.

Both Lee et al. (2000b) and Gutierrez et al. (2008) refocus attention on the use of MRP-like strategies. Lee et al. (2000b) develop a two-stage heuristic using the GT procedure as a starting point followed by an iterative improvement scheme and Gutierrez et al. (2008) incorporates lot size considerations within the GT procedure. Kim et al. (2009) proves that the disassembly scheduling problem is NP-hard and thus confirms the need for heuristic procedures. Their Branch and Bound algorithm using a Lagrangean relaxation is shown to outperform existing heuristics.

Kizilkaya and Gupta (1998) provide the sole contribution that considers stochastic processing times and yields from product returns. Computer simulation is used to assess the impact of varying the number of Kanbans (denoted as the Flexible Kanban System (FKS)) to handle demand changes. Due to its ability to adjust to production uncertainties, they recommend FKS as a viable production strategy for remanufacturers.

3.1.2. No Part Commonality with Finite Capacity

Adding the finite capacity restriction adds complexity to the remanufacturing scheduling problem. Only four articles appear in this section and all are deterministic. The initial work of Lee et al. (2002) laid the groundwork for incorporating a time limit for the disassembly operation to be performed. The authors develop an integer programming (IP) model, which is a reversed form of the capacitated, multi-level, lot-sizing problem. A cost based objective function is used which minimizes the sum of purchase, inventory holding, and disassembly operation costs. Optimal solutions are achieved for small-sized problems.

The next stage of advancement confronts the limitation of the integer program presented in Lee et al. (2002) in solving practical sized problems in reasonable computation time. The three subsequent papers in this section (Kim et al. (2006b and 2006c) and Jeon et al. (2006)) all utilize strategies for relaxing the capacity constraints which make the IP difficult to solve.

Kim et al. (2006b) use a Lagrangean relaxation heuristic to solve the cost based IP formulation of Lee et al. (2002). Both Kim et al. (2006c) and Jeon et al. (2006) develop two-phased heuristics, which first relax the capacity constraint (producing a possible infeasible solution to the capacitated problem) and then invoke an iterative modification routine that works to satisfy the capacity constraint. There are two significant distinctions between the latter two algorithms. Jeon et al. (2006) employ an explicit cost reduction objective, while the goal

of Kim et al. (2006c) is to find the minimum number of items to disassemble. Kim et al. (2006c) invoke an iterative improvement stage, which seeks to satisfy the capacity constraint and simultaneously keeps the objective value of the initial solution. The algorithm of Jeon et al. (2006) incorporates cost changes as part of the improvement phrase and thus entertains changes to the initial objective value.

3.1.3 Part Commonality with Infinite Capacity

The complexity with part commonality arises from the multiple procurement sources for each common part and the additional interdependencies between parts/components (see Figure 5).

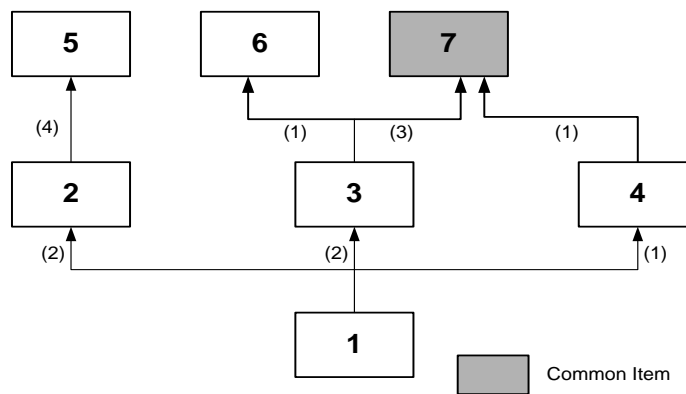


Figure 5: Single Product with Part Commonality

In terms of the research timeline, commonality appears to take precedence over capacity issues with two papers tackling commonality before any efforts to advance knowledge in a capacitated environment. Part and material commonality is widespread in manufacturing due to the cost and operating efficiency benefits. A total of three papers appear in this section.

All open literature within this category address the disassembly scheduling problem with infinite capacity and deterministic parameters. In 1997 Taleb, Gupta, and Brennan (TGB) offer a reverse MRP-based algorithm for a disassembly product structure that includes common parts and materials. Neuendoft et al. (2001) extend the work of TGB (1997) by presenting an algorithm based on Petri Nets. The Petri net model allows for visualization and simulation of discrete event systems. While both the TGB algorithm and the Petri net can deal with large-sized problems, they do not incorporate a cost-based objective. The integer program in Lee et al. (2004a) that minimizes the purchase, setup, holding, and operation costs achieves optimal solutions to problems in the open

literature and near-optimal solutions to an additional test set. However the IP approach is not suitable for large-sized problems due to the computational expense.

3.1.4. Part Commonality with Finite Capacity

Disassembly scheduling that takes into account both part commonality and finite capacity is indeed extremely challenging. While research is available that addresses part commonality and finite capacity individually, we found no articles that incorporate *both* part commonality and finite capacity in remanufacturing disassembly for single products.

3.2 Scheduling Disassembly for Multiple Products

Research pertaining to scheduling disassembly operations for multiple products is outlined in Figure 6.

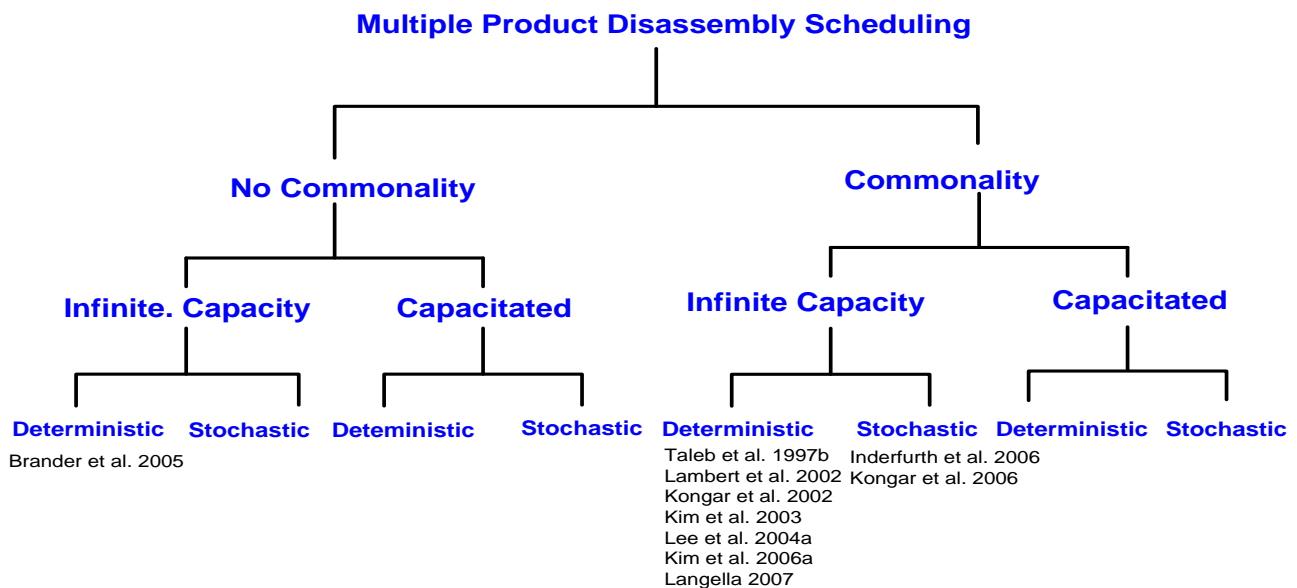


Figure 6: Disassembly Scheduling Research for Multiple Products

3.2.1. No Part Commonality with Infinite Capacity and Deterministic Parameters

The multiple products case with no part commonality is essentially multiple, independent, single products. These are typically run in separate batches and are, thus, *usually* considered a special case under the single product category. However, we found one disassembly scheduling article by Brander and Forsberg (2005) that schedules multiple product lots with sequence dependent set-ups and does not mention whether part

commonality exists. Therefore, to be conservative we assumed no part commonality. The authors develop a cyclic lot-scheduling heuristic to sequence the lots in order to minimize the total set-up and holding costs. The authors mention that future research should address the issue of safety stock due to the reality of stochastic demands.

3.2.2. Part Commonality with Infinite Capacity and Deterministic Parameters

The case of multiple products with part commonality adds additional complexity since there is more than one root item and items that may have more than one parent (see Figure 7).

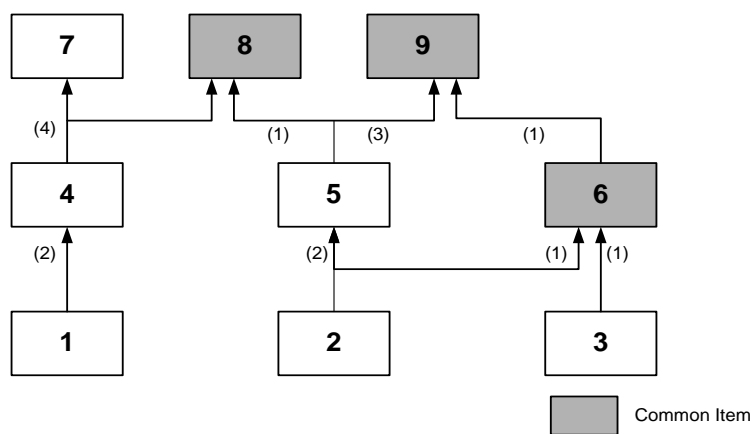


Figure 7: Multiple Products with Part Commonality

As researchers explore more practical-sized problems with increased (and realistic) problem complexity such as parts commonality and longer time horizons, this requires a move away from exact methods due to excessive computational time. Numerous heuristic techniques with varying objectives are shown to provide good solutions. Of the seven papers in this section one paper (Taleb and Gupta, 1997) uses an RMRP-based approach and the remaining papers utilize mathematical modeling techniques. Of the latter set of papers, one (Lambert et al., 2002) presents a solution methodology which accounts for the type of material recovery (i.e., component or full material mining). Lambert et al. (2002) present a modified disassembly graph method that has broad applicability in numerous disassembly environments and is solved optimally via mixed integer programming.

The remaining five papers offer methodological refinements to mathematical models. Specifically, Kongar and Gupta (2002) purport that the remanufacturing environment is ripe to embrace a multiple objective

(i.e., goal programming) strategy given that profit goals and restrictive regulations must be considered simultaneously. Their algorithm allows the disassembly strategy to be assessed by considering six distinct economic and product objectives.

Lee et al. (2004a) is the sole paper in this section to compare their results to Taleb and Gupta (1997). In Lee et al. (2004a) results are presented under two different objective functions (i.e., minimize the number of products to be disassembled and minimize the sum of product disassembly costs) and in both scenarios, their integer program outperforms the two-phase heuristic of Taleb and Gupta (1997). However, the computational burden for large-sized problems is prohibitive.

Kim et al. (2003) and Kim et al. (2006) employ two-phased heuristic procedures which are similar in their first phase in terms of relaxing the integer constraints. In the second phase, Kim et al. (2003) round down the solution and make additional modifications to ensure that the original constraints are satisfied. In Kim et al. (2006) the performance of the second phase is enhanced by implementing a dynamic programming approach that prevents the refined solution from being worse than the solution achieved from phase one of the algorithm. Both algorithmic approaches exhibit promise in solving practical sized problems in reasonable computation time.

Finally Langella (2007) develops an integer programming model with the objective of minimizing the sum of procurement, separation, holding, and disposal costs. A heuristic procedure is developed that modifies the algorithm of Taleb and Gupta (1997) in order to alleviate the potential of infeasible solutions. Results reveal that the algorithm performs well in large majority of generated test problems that vary by product structure, cost, and demand. The performance of the algorithm declines as the problem size grows.

3.2.3. Part Commonality with Infinite Capacity and Stochastic Parameters

Only two publications populate this category. Inderfurth and Langella (2006) study the impact of stochastic yields on remanufacturing scheduling cost. In their initial MIP model formulation they replace the stochastic parameters (yields) with deterministic equivalents and develop two heuristics to solve the problem. Kongar and Gupta (2006) extend their earlier work (Kongar and Gupta 2002) by incorporating uncertainty in terms of the total profit goal, the number of EOL products retrieved from end users or collectors, and the sum of the number of reused and recycled components. The authors utilize fuzzy goal programming (FGP) to solve this

multi-criteria decision problem. FGP allows for the goals of the problem to be characterized with intentional vagueness. Results of a case example provide the number of products returned to satisfy the demand and the number of items reused, recycled, stored, and disposed. Values of numerous other physical, financial, and environmental performance measures are also provided.

3.2.4. Part Commonality with Finite Capacity

We uncovered no articles that address multiple products with capacity restrictions *and* part commonality. While part commonality has been incorporated into multiple product disassembly scheduling, finite capacity represents the next constraint to be incorporated into this arena.

4. SCHEDULING INTEGRATED OPERATIONS

Kim, Lee, and Xirouchakis (2007) encourage the integration of all remanufacturing operations (disassembly, remanufacturing/repair, and reassembly) into the remanufacturing scheduling decisions. In line with their suggestion this section reviews research addressing the scheduling and control of all disassembly, remanufacturing, and reassembly processes. Scheduling integrated operations encompasses the full range of complexities associated with remanufacturing supply chains.

4.1 Scheduling Integrated Operations for Single Products

As depicted in Figure 7 we review the literature in integrated operations scheduling again using the single/multiple product, commonality/no commonality, infinite/finite capacity, and deterministic/stochastic parameter organization.

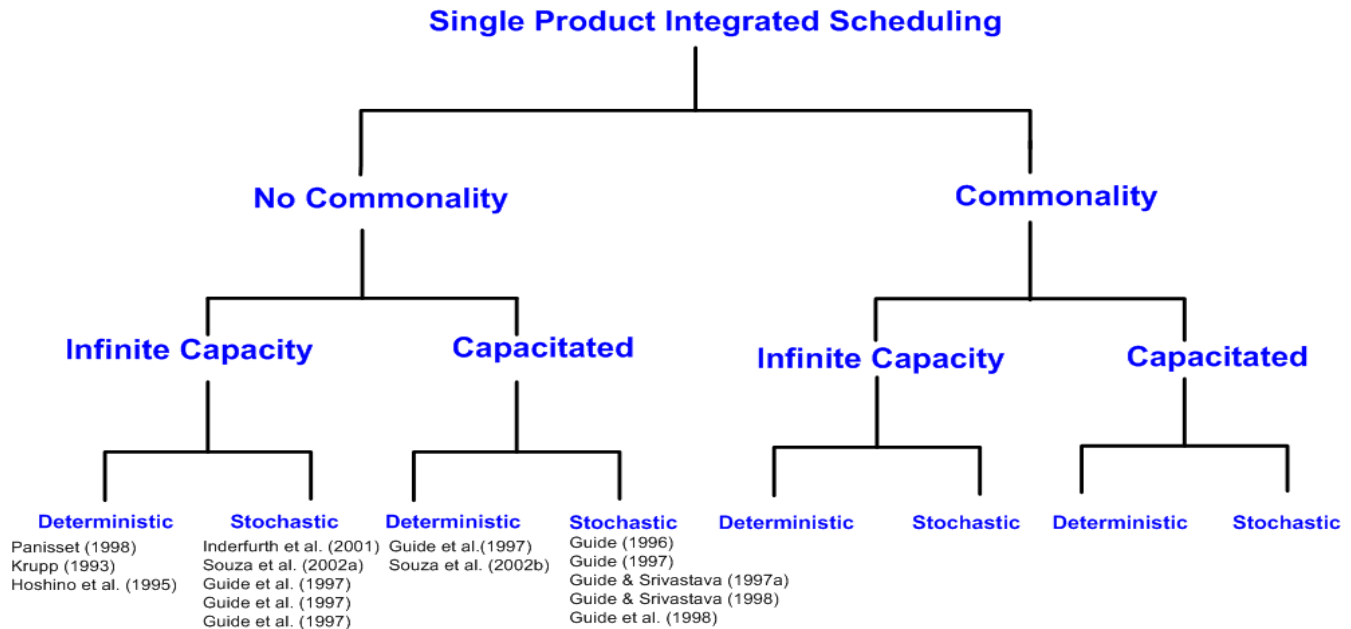


Figure 7. Research on Single Product Integrated Scheduling

4.1.1. Multiple Remanufacturing Options

Materials requirements planning (MRP) encompasses all remanufacturing operations from core returns inventory through reassembly, storage, and shipping. While the MRP planning and control methodology had been a prime choice for OEM manufacturers for years, researchers (e.g., Panisset 1988, Krupp 1993, Gupta and Taleb 1994, Guide and Spencer 1997) recognized that traditional material requirements planning (MRP II) was inadequate to address the needs of remanufacturing due to multiple demand points (leaf items), the divergence property, the uncertain rate of recovery, uncertain routings, uncertain yield from material recovery, stochastic task times, etc. A number of efforts were made to modify or augment elements of MRP to make it more amenable to remanufacturing scheduling. Panisset (1988) recognizes that different repair plans and times would be needed and would often be unknown until the end item was disassembled. He creates different “repair classes” which prescribe different repair operations and times. The planners decide the appropriate repair class. Thus, Panisset handles the uncertain nature of the work (routings, operation times) by creating repair classes and employs the intervention of the planner to select the appropriate repair class before disassembly and modifies the plan, if necessary, after disassembly operations.

Krupp (1993) offers suggestions and evidence of how restructuring and adding additional bills of materials (BOMs) can address some of the challenges of using MRP II systems in a remanufacturing environment. Guide and Spencer (1997) develop a modified bill of resources, which incorporates the percentage of time a particular operation is required, and the frequency that material recovered from a core unit is repairable. These modifications help to account for the variation inherent in remanufacturing. Inderfuth et al. (2001) consider product recovery with multiple remanufacturing options. The objective of this work is to select the correct quantities of product for a specific remanufacturing option such that the costs (i.e., disposal, remanufacturing, stock holding, backordering) are minimized.

Hoshino, Yura, and Hitomi (1995) incorporate three types of part recycling options: reuse the part inside the disposal (recycling) facility, sell the part to the suppliers for its raw material value, or dispose of the part. Souza et al. (2002a) introduce the “sell as is” (non-remanufacturing) option and, in another work (Souza et al. 2007b), satisfy demand by using remanufactured and/or new products. These studies expand the portfolios for using/disposing returned parts and satisfying market demand.

Thus, these seven research efforts strive to introduce options for planning remanufacturing operations by incorporating multiple repair bills, additional BOMs, modified BOMs, use of both new and remanufactured products to satisfy demand, alternate remanufacturing and disposal schemes, and several “sell-as-is” alternatives. These mechanisms help address the complexities of uncertain returns, processing times, customer quantity and delivery demands, and/or product quality.

4.1.2. Product Structure Complexity, Production Control Mechanisms, Inventory Buffers, Disassembly Release Mechanisms, and Priority Scheduling/Expediting Rules

The prior section dealt with increasing the “strategic options” available to remanufacturing planning. This section provides greater detail on how we can best *use* our remanufacturing resources and what can impact their effectiveness.

Guide, Srivastava, and Kraus (1997) test the impact of different types of product structures (simple, intermediate, and tall) on the performance of remanufacturing operations using sixteen different priority-scheduling rules. They conclude that high-level BOM rules perform best for simple structures, with the shortest

processing time (SPT) and dynamic rules the choice for intermediate structures, and the earliest due date (EDD) rule outperforming all for complex structures. In a related work Guide and Srivastava (1997a) evaluate the performance of four order release strategies (level, local load oriented, global load oriented, and batch) and two priority scheduling rules (first come-first served (FCFS) and earliest due date (EDD)) against five performance criteria (mean tardiness, mean flow time, work-in-process, mean idle time, and mean throughput units). The authors conclude that a simple level order release strategy combined with a due date priority scheduling rule provides an effective means of releasing and scheduling work in this environment.

Guide (1996) introduces the drum-buffer-rope (DBR) production philosophy as a means of planning, scheduling, and controlling remanufacturing operations. He promotes this “synchronous manufacturing” methodology as a means to cope with routing uncertainties (frequency and time) and required task sequences. He learned that the DBR approach, regardless of buffer size multiplier outperformed the MRP-based method on every performance measure. Guide concludes that the inventory buffer multipliers help the system to cope with variability in the remanufacturing environment. Related to this research is the later work done by Guide and Srivastava (1997b) which examined the use of safety stocks in a MRP production system and the impact of the location of buffer inventory on remanufacturing performance (Guide and Srivastava 1998). These findings reveal that inventory safety stocks, positioned correctly in the system and up to a certain level, do improve performance for both MRP and DBR environments.

Guide (1997) examines the impact of different priority scheduling or dispatching rules (PDR) on the performance of DBR methodology at non-constraint work stations. He concludes that at low levels of utilization any PDR performs well, at intermediate levels EDD or FCFS work well, and at high levels, no PDR performed well. Guide, Srivastava, and Kraus (1998) investigate the performance of proactive expediting policies with different product structures and disassembly release mechanisms (DRM). They find that the proactive expediting systems do not significantly improve performance and that the performance of these policies decreases with increasing product complexity. They also report that the disassembly release mechanisms (DRM) do not affect the performance of the expediting policies nor was there any difference in the performance of the various DRMs.

All seven studies in this section employed stochastic variables and computer simulation, which has been a primary computational methodology to address uncertainty. Product complexity has proven to be of significance in scheduling performance and emphasizes the importance of product design in remanufacturing efficiency considerations. DBR has been shown, particularly with buffer inventories, to outperform the traditional MRP approach in the uncertain, remanufacturing environment and, thus, merits added attention. Interestingly DRMs and proactive expediting policies do not have the impact on scheduling performance as that shown, for example, by product structure.

4.2. Scheduling Integrated Operations for Multiple Products

Figure 8 organizes the fourteen citations in this category using the product/commonality/capacity organizational structure. The literature is again briefly discussed by topical significance.

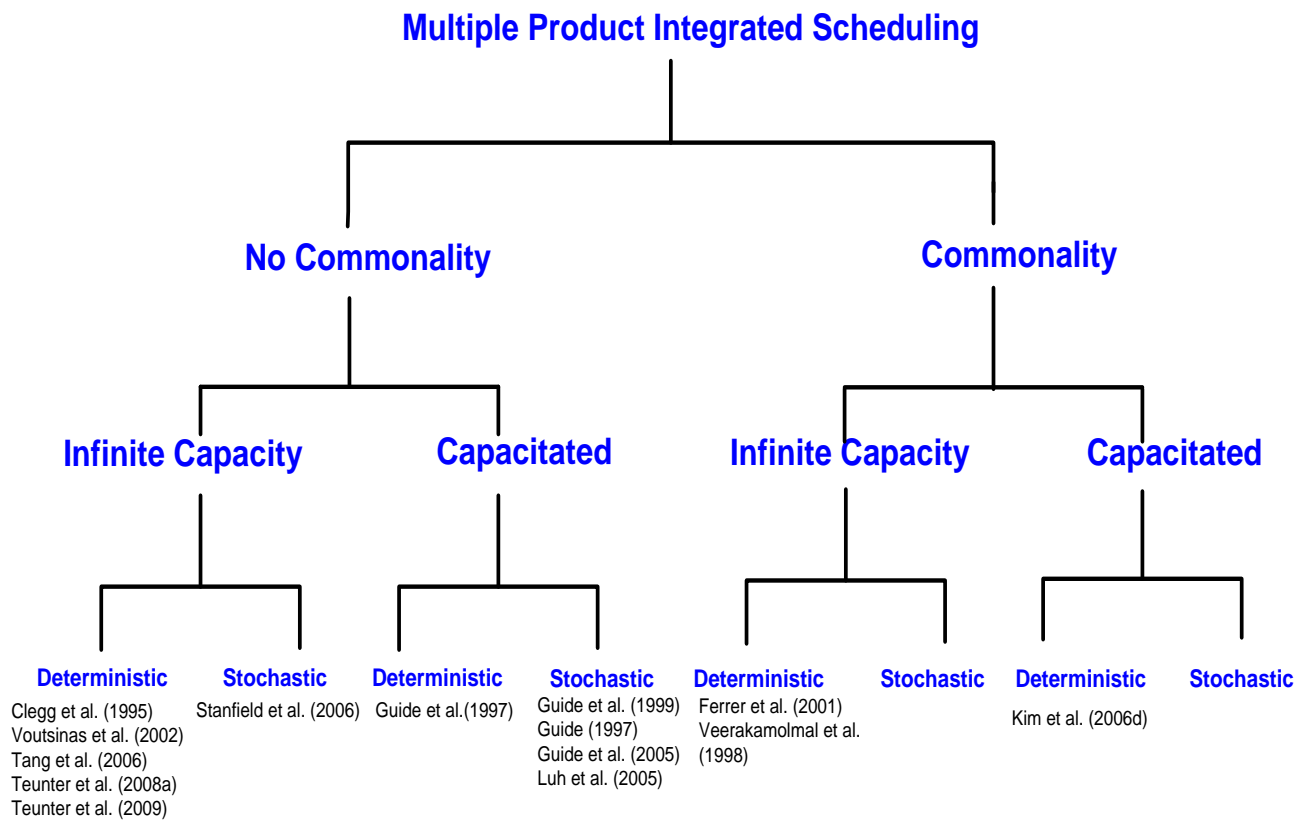


Figure 8. Research on Multiple Product Integrated Scheduling

4.2.1. Economic Lot Scheduling and Sequencing

Researchers have also explored the well-known economic lot scheduling problem (ELSP) within the context of remanufacturing. In its classic form, the ELSP arises when more than one product is to be produced on the same machine. The challenge is to determine both the lot size and sequence of production for each product that minimizes the long run holding and set up costs.

According to Tang and Teunter (2006), the ELSP is complicated further when product returns are incorporated in the manufacturing process. First, manufacturing and remanufacturing lot sizes are restricted by the return/demand ratio. Second, sequencing plays a larger role than in the traditional ELSP since it impacts the inventory holding costs. This problem is referred to as the economic lot scheduling problem with returns (ELSPR) in the open literature.

Veerakamolmal and Gupta (1998) develop a procedure, which sequences multiple, single-product batches through disassembly, and retrieval operations to minimize machine idle time and makespan. Lot sizes are simply determined by the number of arrivals per product in a given time period.

Standfield, King, and Hodson (2006) expand the realm of lot sizing and sequencing to include the start dates for each lot. They propose a heuristic based on an interchange routine that develops sequences and start times for jobs in a remanufacturing flowshop. Computer simulation runs show the heuristic outperforms common list rules in average stochastic makespan and worst case.

Tang and Teunter (2006) address the multi-product ELSPR when both manufacturing and remanufacturing occur on the same production line. Teunter, Kaparis, and Tang (2008) extend this work by deriving a mixed integer program to solve the ELSPR when manufacturing and remanufacturing operations are performed on separate dedicated lines. Given the computational complexity of the latter approach, the authors later advance the study of the ELSPR by developing high performing heuristics that increase the chances of implementation in the world of practice (Teunter, Tang, and Kaparis, 2009).

Thus, the remanufacturing lot scheduling/sequencing research addresses: (1) the basic lot scheduling problem through disassembly and retrieval operations, (2) establishing production lot start dates, (3) determining

the lot schedules for new and remanufactured products produced on the *same* line and for new and remanufactured products produced on *dedicated, separate* lines, and (4) developing high performance heuristics for enhanced computational performance. Most efforts employ deterministic parameters and performance or economic objectives. It should be noted that the research involving Tang, Teunter, or Kaparis (2006, 2008, and 2009) maintain the same objective function (minimize set-up and holding costs) and emanated from study of the same company. This allows a “cleaner” comparison of the studies and permits a longitudinal glimpse of a remanufacturing company’s transformation. These studies subtly reveal that a remanufacturing firm’s scheduling needs (and problems) may change as a function of its product life cycles. This suggests that it may prove beneficial to study the scheduling needs of various types of remanufacturing companies at different points in their product life cycles and assess any changes.

4.2.2. Part Commonality

Interestingly no integrated remanufacturing articles were located that addressed part commonality within a *single* product. We uncovered only three articles that incorporated part commonality among multiple products; all use deterministic parameters.

Two articles allow part commonality with infinite capacity. Veerakamolmal and Gupta (1998) allow part commonality among multiple products in their heuristic; however, lot sequencing is their primary focus. Ferrer and Whybark (2001) include part commonality within their modified MRP/LP integrated planning system. They develop a Bill of Materials Matrix (which shows part commonalities across multiple products), the materials requirements plan for each part, and the Disassembly Bill of Materials Matrix, which shows yield data for each part (expected % of good parts per core).

Clegg, Williams, and Uzsoy (1995) allow common modules across multiple products in their LP aggregate model of remanufacturing. They incorporate labor hour capacity restrictions on disassembly and reassembly operations in their formulation, which determines how much product to disassemble, how much of each component to reuse versus dispose, and how much of each product to remanufacture or make new. As in Ferrer and Whybark (2001), Kim, Song, Kim and Jeong (2006) utilize a multiple

product BOM, handle part commonality across multiple products, and utilize math programming to determine the number of cores to purchase. However, the latter incorporate capacity constraints at the collection, refurbishing, and disassembly sites. In addition they investigate the external sourcing of parts as well as products (cores). Finally, they use mixed integer programming, rather than LP, to determine how many cores should be designated for remanufacturing and how many new parts, as well as cores, should be outsourced from an external supplier, such that the cost savings from remanufacturing are maximized. Results indicate that an optimal remanufacturing capacity exists and that additional capacity expansion does not improve the cost savings.

4.2.3. Order Release Mechanisms, Priority Dispatching Rules, and Control Mechanisms

Four articles span the realm of disassemble release mechanisms, dispatching rules, priority dispatching rules, and reassembly accelerator options for multiple product environments. Interestingly, all these works employ stochastic variables. Guide, Kraus, and Srivastava (1997) comprehensively test the performance of fifteen priority dispatching rules and four disassembly release mechanisms against four performance measures. They find that: (1) there are no significant performance differences among the disassembly release mechanisms and interestingly the time-phased release mechanism provides no significant advantages over the simpler mechanisms, (2) due date priority rules (EDD) provide good, and in some cases the best, overall performance, and (3) the use of reassembly accelerator rules to proactively expedite parts to the assembly operation makes no significant difference in any of the performance measures. Guide, Jayaraman, and Srivastava (1999) assess the effect of lead time variation on the performance of disassembly release mechanisms. They find that at all levels of variation the “first off- first to shop” (FOFS) release mechanism performs well, particularly for serial specific parts and, therefore, encourage the use of the FOFS DRM for both serial number specific and common part. Along the same path Guide, Souza, and van der Laan (2005) find that under certain capacity and process restrictions, delaying a component to the shop after disassembly never improves system performance. Luh et al. (2005) develop a Lagrangean-Relaxation-based (LR) approach to schedule a single overhaul center with multiple

repair shops. Their formulation can handle multiple machine types, machine capacity constraints, common or serial dedicated parts, uncertain arrival times, and stochastic repair times.

Much of the reported work in this section suggests that “simpler is better”. The simple FOFS DRM performs well for both common and serial parts. Sophisticated assembly accelerator rules were shown to exhibit little performance effect. The earliest due date performs well when measured against more complex priority dispatching rules. Thus, for many instances, the straight forward FOFS DRM and EDD priority rule are strongly suggested, while sophisticated accelerator rules are not.

4.2.4. Deteriorating Job Values

This section addresses a relatively new, but important, topic in multiple product, remanufacturing scheduling— deteriorating job values. Electronics and other high technology products, in particular, may continuously lose value while remaining in the remanufacturing supply chain. We located only two articles that relate job value deterioration to remanufacturing. Voutsinas and Pappis (2002) develop a heuristic procedure for scheduling n jobs on a single machine where the job values deteriorate with their starting times. The heuristic, which maximizes the aggregate value of all jobs, outperforms results of a random sequence. Heuristic performance decreases with problem size. Rant, Gupta, and Swami (2008) explore the problem presented in Voutsinas and Pappis (2002) by illustrating nine heuristic procedures addressing several operational considerations (e.g., finite machine capacity and job value truncation). Computational results reveal that near-optimal solutions are achieved for a large number of problems.

Product deterioration adds an additional cost, in addition to inventory holding cost, for delaying a product’s remanufacturing. While yet modest, we fully expect the topic of remanufacturing product value deterioration to receive greater attention in the future, perhaps based on empirical analyses and data. Deterioration based on completion time rather than start time, more efficient solution methodologies for larger scale problems, and the use of a combination of heuristics remain as fertile areas of future exploration.

5. UNCERTAINTY AND STOCHASTICITY

Guide, Kraus, and Srivastava (1999) emphasize that remanufacturing systems face a greater degree of uncertainty and complexity than traditional manufacturing systems and thus, require planning and control systems designed to deal with the added uncertainty and complexity. A number of researchers support this position (e.g., Flapper 2002, Gupta and Taleb 1994, and Johnson and Wang 1995). Guide (2000) insists that managers must be deliberate in their actions to reduce the uncertainty in the remanufacturing environment and provides a framework (six managerial guidelines) for product acquisition that links reverse logistics activities with production planning and control activities.

The high degree of uncertainty surrounding remanufacturing as well as its causes (uncertain returns and their quality, stochastic routings and processing times, disposal and scrap percentages, customer demand, etc.) have been known for some time. Early efforts to address these stochastic elements used additional operational and marketing options such as multiple repair bills (Panisset 1988), additional BOMs (Krupp 1991), a modified Bill of Resources (Guide and Spencer 1997), and alternate remanufacturing and “sell-as-is” options (Souza et al. 2002a, b). These multiple, *deterministic* options or scenarios were progressively augmented by stochastic techniques. As shown in Table 1 the most prevalent, stochastic technique used to investigate remanufacturing (scheduling) uncertainty has been computer simulation. Guide and coauthors have relied on computer simulation for many research efforts. These include: (1) the impact of product structures (Guide, Srivastava, and Kraus, 1997), order release strategies and priority scheduling rules (Guide and Srivastava, 1997a), and inventory buffers on remanufacturing performance (Guide and Srivastava, 1997b, 1998); (2) the use of the drum-buffer-rope philosophy to cope with routing and task time uncertainties (Guide, 1996), (3) the performance of proactive expediting policies with different product structures and disassembly release mechanisms (Guide, Srivastava, and Kraus, 1998); and (4) the effect of lead time variation on the performance of disassembly release mechanisms (Guide, Jayaraman, and Srivastava, 1999). These efforts all sought to reduce the uncertainty inherent in remanufacturing and its scheduling efforts. In many of these studies the set-up and processing times are stochastic, often modeled using beta distributions based on historical data. Kizilkaya and Gupta (1998) use computer simulation to study material flow in a disassembly environment using the Flexible Kanban System (FKS). In their study the disassembly time at each station is modeled using an exponential distribution. Thus, we

see computer simulation harnessed with well-known statistical distributions to successfully study the stochastic complexities of remanufacturing.

Deviating from the computer simulation approach Inderfurth, de Kok, and Flapper (2001) develop a stochastic, dynamic optimization model to tackle the complex problem of determining optimal or near-optimal, periodic review inventory policies necessary to support various remanufacturing options (including disposal). Inderfurth and Langella (2006) develop a MIP/heuristic procedure to incorporate stochastic yields which are uniformly distributed. These latter two approaches notwithstanding computer simulation may be the most powerful methodology to study the impact of numerous stochastic complexities simultaneously.

It bears mentioning that, while computer simulation is an appropriate methodology to *study* the impact of various uncertainties, individually or in combination, of the remanufacturing environment (e.g., market demands, rates of returns, processing times, routings, etc.) and properties of the remanufacturing system (e.g., the selection of the DRM, the scheduling priority rule, the size and location of buffer inventories, and the use of scheduling accelerator rules), it is unlikely that computer simulation will be employed to actually *schedule* remanufacturing. Remanufacturing scheduling will likely utilize the results of the computer simulation studies to establish managerial guidelines, dispatching rules, procedures, yield averages, etc. for the actual scheduling. Managerial decisions such as core purchases, inventory buffer size determination, and lot sequencing/sizing may well continue to employ stochastic procedures operationally.

Finally, despite the progress made in addressing the uncertainty/stochasticity inherent in remanufacturing scheduling, no studies have yet incorporated all of Guide's eight complexities (at least five of which are stochastic - demand, quantity of returns, timing of returns, material recovery, routings and processing times). Kongar and Gupta (2006) used fuzzy goal programming (FGP) to explore three uncertainties – the profit goal, the number of EOL products retrieved, and the sum of reused and recycled components. A number of researchers have addressed two stochastic elements. These include: Kizilkaya and Gupta (1998) (defective products and uncertain disassembly times), Inderfurth et al. (2001) (returns and demand), and Teunter and Vlachos (2002) (demand and returns per time unit). Thus, while the progress made is unmistakable, the simultaneous solution of all the stochastic complexities remain to be tamed.

6. OBJECTIVE CRITERIA/FUNCTIONS AND SCHEDULING/PLANNING METHODOLOGIES USED

6.1. Objective Criteria/Functions

As shown in Table 2 forty-four different objective criteria/functions have been employed in remanufacturing scheduling studies. The use of objective criteria seemed to span three eras. Usage of RMRP-type objective criteria (satisfy demand for the time period, minimize the root items utilized to satisfy demand, and minimize the lot size and lead time) was predominant in the late 1980's and early 1990's. This was followed by more sophisticated technical, performance-based criteria such as minimize flow time, tardiness, root mean square tardiness, % of parts expedited, idle time, stockouts, safety stock, machine idle time, WIP, and makespan and maximize throughput. The third period, the economic period, gained its foothold around 2002. Published research, most involving linear, integer, or dynamic programming, now employed a variety of economic (cost-oriented) objective functions. These costs included set-up, holding (cores and/or disassembled parts), purchase (cores), disassembly, and disposal (defective cores and parts). Even five different maximize profit functions (e.g., revenue - disassembly cost - disposal cost) are noted; the differences being in whether or not they included revenue from remanufactured and new products and which costs were included. Thus, while RMRP-type still appear (e.g., Barb-Guitierrez and Gupta, 2008), the economic objectives now appear dominant.

6.2. Scheduling/Planning Methodologies

The study of remanufacturing scheduling, planning, and control has attracted a number of varied methodologies. As depicted in Table 2 twenty-five different quantitative solution methodologies have been used. Reverse MRP was the initial methodology of choice for disassembly planning. Guide and his associates introduced the use of computer simulation to disassembly/remanufacturing scheduling research throughout the 1990's. One benefit, of course, was that computer simulation could employ stochastic data. Much research on disassembly release mechanisms, priority dispatching rules, buffer inventory locations, the influence of product structure, and control mechanisms were conducted utilizing this methodology. Even the use of Kanban (drum-buffer-rope) and flexible Kanban has been applied with noted advantages. The mathematical programming era launched in earnest circa 2002 and research utilizing linear, integer, dynamic, goal, and fuzzy goal programming

appeared. These models addressed directly the disassembly scheduling problem and were typically coupled with economic objective functions. We noted one article (Neuendorf et al., 2001) that utilized Petri nets. While we note the occasional use of the reverse MRP approach (Barb-Guitierrez and Gupta, 2008), the mathematical programming methodologies appear to be currently prevalent.

While mathematical programming (e.g., IP, MIP) is an appropriate methodology for *model formulation* and can achieve optimal solutions for restricted, test problems, heuristics still offer the best hope for *achieving* useful, near optimal solutions for realistically-sized scheduling efforts. Much effort has and continues to be devoted to more efficient, multi-stage heuristics.

7. SUMMARY AND DISCUSSION

To address research question 1 the remanufacturing scheduling literature was classified into single versus multiple products and further separated using part commonality, capacity, and deterministic/stochastic parameters. This provides an alternative, investigative “view” of remanufacturing scheduling, in addition to the traditional “topical” classification. Progress in each dimension was reviewed. In addition research into stochasticity/uncertainty issues was reported. Finally, objective criteria and scheduling methodologies were reviewed. Some of the more notable findings from these analyses are further discussed.

The next few paragraphs will summarize our current progress in remanufacturing scheduling and, thus, address research question #2. For the single product problem of determining the number of end items and parents needed to satisfy the demand for all leaf items assuming infinite capacity, no part commonality, and deterministic parameters has been solved using the RMRP approach. While the RMRP methodology inherently satisfies demand, it is silent on further objectives such as economic considerations. For the same conditions linear and integer programming models with cost-based objective functions have been successfully developed to achieve optimal solutions to size-restricted, test problems. The performance of the IP models worsen as the number of items and time periods increase.

When part commonality is added to the above conditions optimal solutions with varying objectives can be achieved using RMRP, Petri Nets, or various LP/IP formulations. Again, optimal solutions using IP models have been accomplished for restricted problems with near-optimal solutions achieved for larger, test problems.

Fewer results have been reported for stochastic parameters. Kizilkaya and Gupta (1998) show how a simulation model coupled with a flexible Kanban system can be employed to incorporate defective products and uncertainty in the disassembly time into disassembly scheduling.

Existing research on the multiple product case with part commonality assumes infinite capacity and, in most cases, deterministic parameters. RMRP, LP, IP, GP, DP, and multi-phase heuristic procedures have been utilized to achieve optimal solutions to restricted test problems and near-optimal solutions to larger, more realistic problems. Only two works address stochasticity/uncertainty in this area. Inderfurth and Langella (2006) allow stochastic yields in their MIP/heuristic formulation; however, they replace the stochastic parameters with deterministic equivalents. Kongar and Gupta (2006) elevate their earlier GP methodology (2002) into FGP; this allows the multiple financial and operational goals to be characterized with vagueness.

While the basic problem and the incorporation of several complexities such as part commonality and multiple goals (for single products) has been optimally solved, the Lagrangean and heuristic techniques appear to offer the best avenue to achieve acceptable solutions to real-world sized problems with added complexities such as capacity restrictions.

When examining the scheduling of *integrated operations* several innovations are noted that increase the order release options. Additional “repair bills”, BOMs, or Bills of Resources augmented with planner intervention, were developed to handle the different operations and times needed to repair returns with varying quality. Cost considerations were expanded to cover disposal, remanufacturing, holding, and backordering. Choices for satisfying market demand were augmented to include substituting new for remanufactured products and the “sell as is” option.

In this environment product structure, level of remanufacturing utilization, and part buffers play important roles in the performance of integrated operations. High-level BOM rules perform best for simple structures, with the SPT and dynamic rules the choice for intermediate structures, and EDD outperforming all for

complex structures. As the level of utilization increases, the EDD rule dominates. However, at high utilization levels none of the PDR rules perform well and part buffers must be enlarged. DBR methodologies show promise as they outperform MRP-based methodologies on all performance measures tested. Again, larger buffer inventories help with system variability and performance. Finally, proactive expediting policies do not show significant performance improvement.

Mixed integer programming has been utilized to determine the number of cores designated for manufacturing and how many parts to purchase externally in order to maximize remanufacturing cost savings in the multiple products environment with part commonality. Results indicate that an optimal manufacturing capacity exists.

As for the single product, integrated operations environment research reveals that simple DRMs and priority scheduling rules (EDD) have advantages over more sophisticated variations for a wide range of common complexities. The advantages of simple DRMs, and the EDD priority rule may be encouraging to practitioners seeking user-friendly methodologies.

Kanban and flexible Kanban systems can be used to control the flow of material throughout remanufacturing operations. Several studies have shown the advantages of traditional Kanban systems over RMRP production systems and flexible Kanban systems over traditional Kanbans. Flexible Kanban is shown to outperform a traditional Kanban system in terms of shortages. Apparently Kanban systems, in general, warrant greater research exploration due to their ability to better handle uncertainty in the remanufacturing environment.

The complexities and uncertainties innate to remanufacturing are significant obstacles. Research question #3 seeks to uncover the advances accomplished in this area and the work remaining. We report that several works address stochastic elements in remanufacturing scheduling. All assume infinite capacity. Inderfurth and Langella (2006) incorporate stochastic yields in their MIP/heuristic formulation. Kizilkaya and Gupta (1998) use computer simulation to study the performance of a flexible Kanban system for a single product allowing defective products and uncertain disassembly times. Kongar and Gupta (2006) employ fuzzy goal programming to study a multiple product environment with an uncertain profit goal, the number of products retrieved from end users or collectors, and the sum of reused and recycled components. Computer simulation, and stochastic dynamic optimization have

been employed in other studies related to remanufacturing. By far the “work horse” stochastic methodology of choice has been computer simulation. While an effective “what if” research methodology to study many aspects related to remanufacturing scheduling, its application as a real time remanufacturing scheduling methodology is questionable. Flexible Kanban, provides a closer and promising vehicle for remanufacturing production implementation and control. Stochastic, dynamic optimization and fuzzy goal programming deserve greater attention and may be methodologies that can be used for remanufacturing scheduling with stochastic elements, but more work in this area is needed.

Despite this progress only two of Guides’ stochastic complexities and three uncertainties have been incorporated into remanufacturing scheduling models. While commendable, many research complexities remain to be challenged, particularly in combination.

Identifying (and analyzing) the objective functions used in remanufacturing scheduling is the intent of research question #4. We note that objective criteria include three major types: MRP-oriented, technical or performance-based, and economic. These three types of objectives seem to have dominated separate periods. Understandably the MRP or RMRP variety was the early choice in the 1980’s and early 1990’s, followed by the technical, performance-based criteria of the late 1990’s and early 2000’s, succeeded by the economic criteria commencing about 2002. While the MRP/RMRP criterion (satisfy customer demand per period) still is visible, the economic criteria are more readily apparent. The current thrust seems to be to include more costs (and profits) covering a broader expanse and life cycle of the remanufacturing system (core acquisition, disassembly, remanufacturing, inventory holding, disposal, etc.). It should be mentioned that use of such a wide variety of objective functions (44) makes a comparison of solution methodologies and their efficiency difficult. Some consensus on the appropriate (or more realistic) objective(s) would be helpful in such a mega-analysis of research progress.

Finally, research question #5 focuses on the research methodologies utilized. We describe a variety of research methodologies employed to study remanufacturing scheduling, planning, and control. The initial RMRP methodology has been augmented with Kanban; flexible Kanban; computer simulation; linear, integer, mixed

integer, dynamic, goal, and fuzzy goal programming; Petri nets; and a variety of single and multiple stage heuristics. While restricted-size test problems have been optimally solved, realistic size problems appear to require Lagrangean and/or heuristic techniques to achieve acceptable solutions. One might predict that computer simulation will be the methodology of choice for studies that incorporate significant, stochastic complexities, with continued work in the mathematical programming/heuristics-arena for deterministic investigations. Computer simulations, fuzzy goal programming, more efficient heuristics, and even enhanced flexible Kanban system approaches offer intriguing future possibilities for remanufacturing (scheduling) research.

However, while much progress has been made in understanding the complexities surrounding the remanufacturing scheduling problem and in developing/testing solution methodologies, additional research is apparent. The next section suggests some areas of research attention.

8. AREAS FOR FUTURE RESEARCH

It can proceed without comment that the barren, end branches in Figures 4, 6, 7, and 8 signal research needs. The combination of finite capacity (e.g., machine, labor, storage), part commonality (within the same product and across multiple products), and stochastic parameters (core returns, processing times, processing routes, material recovery, production scrap, product demand, etc.) are complex, stand-alone issues to address and extremely formidable in combination. Yet, these are the unresolved areas for research.

We agree with the recent suggestions put forth by Kim et al. (2007), which call attention to the need to:

- *Incorporate backlogging, realistic stochastic considerations, and multiple periods into disassembly scheduling.*

All are realistic factors impacting remanufacturing scheduling, but have not yet been integrated into one model.

- *Emphasize a need to integrate disassembly process planning with disassembly scheduling.*

The design of the disassembly process plan must precede the operation of disassembly scheduling. The efficiency of the scheduling process depends in large measure on the effectiveness of the process prescribed

for disassembly, remanufacturing, and reassembly.

- *Encourage the integration of all the remanufacturing operations (disassembly, remanufacturing/repair operations, and reassembly) into the remanufacturing scheduling decisions.*

The efficiency, lead time, quality, and cost of the remanufacturing process is dependent, not only on the disassembly operation, but on all the operations required for remanufacturing. Thus, rather than optimizing one aspect of the remanufacturing process, one must take an integrated systems view and optimize the entire remanufacturing process.

We pose several pertinent questions and offer some additional suggestions for future research:

- It is not clear what objectives, methodologies, constraints, etc. practitioners currently use in their remanufacturing scheduling operations. An industrial survey could assess what difficulties practitioners face, what they feel they need, and in what form. One hypothesis is that practitioners need more than an appropriate and computationally efficient model, they want a complete computer package - flexible, ready to run, and user-friendly.
- The simulations and models of remanufacturing scheduling and performance concern mainly technical data, operations, and decisions. However, remanufacturing design and performance can be influenced by strategic, managerial, economic, and behavioral issues and decisions. How have these issues impacted remanufacturing scheduling, operations, and performance, and how are they accommodated?
- While there has been some research involving multiple criteria (Hoshino et al., 1995; Kongar & Gupta, 2002 & 2006) most research efforts have used singular objectives. Since remanufacturing employs an economic, socio-technical system would managers desire to achieve or trade-off multiple objectives? Thus, we should support research employing technical, economic, strategic, and/or humanistic goals, which may provide a greater challenge, but result in more useful and realistic solutions.
- Guide (2000) exposed eight characteristics that complicate remanufacturing planning and control. Are they all a concern to all remanufacturers? Are they all equally important? Are there precedent relationships among them? Conduct a survey of remanufacturers to learn which of these are important to companies by

industry, by product, by process type, and by position of their product life cycle. Conduct an ABC analysis to determine the most-to-least important complexities overall and by industry group. It may then be feasible to develop models specifically tailored for each group. If longitudinal studies were conducted, it may be possible to determine how these complexities and their importance change over time.

- Kizilkaya and Gupta (1998) suggest that as customer satisfaction becomes a more differentiating factor between manufacturers, flexible Kanban systems (FKS) may give remanufacturers the ability to reduce delivery times and shortages while keeping average WIP inventory levels at reasonable levels compared to batch manufacturing strategies. While Kizilkaya and Gupta (1998) determine the number of Kanbans to be added or removed from a FKS system based on a percentage of the (stochastic) demand, what procedures can be developed to provide the optimal numbers of base Kanbans employed in the system and the amount to be added or removed from the base in a stochastic environment?
- It would be useful to learn what can be or has been the technical (less operations variability) and economic impact of production and reassembly automation/robotics on remanufacturing scheduling?

Indeed, while much has been advanced, many remanufacturing industry needs yet remain for future research.

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Table 1: Literature Analysis of Efforts to Address Uncertainty and Stochasticity

Reference	Study Purpose and Findings	Deterministic Option or Stochastic Technique	Stochastic Variables and Distribution(s) Used
Panisset (1988)	Recognized that different repair plans and times would be needed and would often be unknown until end item was disassembled. Creates different “repair classes” which prescribe different repair operations and times. The planners decide the appropriate repair class.	Multiple repair bills	None
Krupp (1991)	Offers suggestions and evidence of how restructuring and adding additional bills of materials (BOMs) can address some of the challenges of using MRP II systems in a remanufacturing environment	Multiple BOMs	None
Guide and Spencer (1997)	Develop a modified bill of materials method. This BOM incorporates the occurrence factor (OF) percentage of time that a particular operation is required, and a material recovery rate (MRR), the frequency that material recovered from a core is repairable.	Modified Bill of Resources	None
Souza, Ketzenberg, and Guide (2002)	Investigate various dispatching rules to determine the optimal remanufacturing policy. Introduces “sell as is” (non-remanufacturing) option, which expands portfolio of choices for satisfying market demand. Uses GI/G/1 queuing network and simulation to determine optimal, product mix. Objective is to maximize profit while achieving a desired service level (flow time).	GI/G/1 queuing model and computer simulation	Stochastic arrivals and processing times. Use of Poisson random variables with specified mean.
Souza and Ketzenberg (2002)	Devise a two stage GI/G1 queuing network model to determine the optimal blend of remanufactured and new product produced in the same facility to satisfy demand. Objective is to determine the long run production mix that maximizes profit subject to a lead time constraint.	GI/G/1 queuing model and computer simulation	Stochastic product returns and production yield
Guide (1996)	Introduces/promotes the drum-buffer-rope (DBR) production philosophy as a means of planning, scheduling, and controlling routing uncertainties in remanufacturing operations. Concludes that: (1) DBR approach, regardless of buffer size multiplier outperforms MRP-based method and (2) inventory buffer multipliers help cope with variability in the remanufacturing environment.	Computer simulation	Number of units required in each quarter generated from a discrete distribution based on actual data. Set-up times and processing times were based on Beta distributions based on actual data.
Guide and Srivastava (1997a)	Use computer simulation to evaluate the performance of four order release strategies and two priority scheduling rules (FCFS and EDD) against five performance criteria. Authors conclude that a simple level order release strategy combined with a due date priority scheduling rule provide an effective means of releasing and scheduling work in this environment.	Computer simulation	Uses a probabilistic routing file and machine set-up times for selected resources are based on beta distributions
Guide, Srivastava, and Kraus (1997)	Use computer simulation to test the impact product structures (simple, intermediate, and tall) on performance of remanufacturing using different priority-scheduling rules. They conclude that high-level BOM rules perform best for simple structures, with the SPT and dynamic rules the choice for intermediate structures, and EDD outperforming all for complex structures.	Computer simulation	Core arrival rates, and disassembly and reassembly times were modeled using exponential distributions.

Table 1: Continued

Reference	Study Purpose and Findings	Deterministic Option or Stochastic Technique	Stochastic Variables and Distribution(s) Used
Guide and Srivastava (1997b)	Examine the impact of buffer inventories on remanufacturing performance in MRP environment. Authors conclude that safety stocks must be kept in the system but only at recommended minimum levels. They also recommend that companies also investigate reducing lead times and the variation in demand.	Computer simulation	Uniform and beta distributions were used to determine homogeneous and heterogeneous material recovery rates respectively. Demand variability for each product was set using a predetermined mean and coefficient of variation.
Guide and Srivastava (1998)	Examine the impact of buffer inventory locations on remanufacturing performance. Results show that inventory buffer decisions are significantly affected by the disassembly release mechanism (DRM). Authors suggest: (1) for common parts use a time-phased, minimum flowtime DRM and reassembly buffer and (2) for serial number parts sue a flush DRM with mixed buffer locations (at disassembly and reassembly).	Computer simulation	Uses a probabilistic routing file, exponentially distributed times between arrivals and beta distributions to determine processing times.
Guide, Srivastava, and Kraus (1998)	Investigate the performance of proactive expediting policies (PEPs) with different product structures and disassembly release mechanisms (DRMs). Using computer simulation they find that the (PEPs) do not significantly improve performance and that the performance of these policies decreases with increasing product complexity. Also report that the (DRMs) do not affect the performance of the expediting policies.	Computer simulation	Uses a probabilistic routing file, exponentially distributed times between arrivals and beta distributions to determine processing times.
Guide, Jayaraman, and Srivastava (1999)	Use computer simulation to assess the effect of lead time variation on the performance of DRMs. They find that at all levels of variation the FOFS release mechanism performs well, particularly for serial specific parts. Authors encourage the use of the FOFS DRM for both serial number specific and common parts over a range of lead time variances.	Computer simulation	Uses a probabilistic routing file, exponentially distributed arrivals and gamma distributions to determine disassembly and reassembly processing times.
Kizilkaya and Gupta (1998)	Explore stochastic disassembly processing times, and uncertain quality of returns in flexible Kanban planning/control system. Results indicate as number of Kanbans increase, WIP increases, but completion times and shortages decrease.	Computer simulation	Disassembly times at each work station are modeled using Exponential distributions
Inderfurth, de Kok, and Flapper (2001)	Consider product recovery with multiple remanufacturing options. Objective is to select the correct quantities of product for a specific remanufacturing option such that costs (i.e., disposal, remanufacturing, stock holding, backordering) are minimized.	Stochastic dynamic optimization	Product returns and demands are stochastic

Table 1: Continued

Reference	Study Purpose and Findings	Stochastic Variables and Distribution(s) Used	Stochastic Variables and Distribution(s) Used
Kongar and Gupta (2006)	Extend earlier work (2002) by incorporating uncertainty of total profit goal, EOL products retrieved, and sum of reused and recycled components. Utilize fuzzy goal programming to solve multi-criteria decision problem. Model is tested using a case example of three products	Fuzzy goal programming	Goals: (1)The total profit goal (2) The number of EOL products received per period (3) The sum of reused and recycled components
Inderfurth and Langella (2006)	Study the impact of stochastic disassembly yields on remanufacturing scheduling. Develop a MIP model incorporating stochastic yields, but replace the stochastic parameters with deterministic equivalents and solve using two heuristics. Results show improvement over deterministic methods.	Mixed integer programming and heuristics	Yields from disassembly are considered stochastic. The uniformly distributed, stochastic yield variables are replaced by deterministic equivalents via two heuristic approaches

Table 2: An Analysis of Remanufacturing Scheduling Research

Reference	Year	Operations Focus	Production Strategy ³	Product-Related	Process-Related	Work Schedule Related ⁴	Performance	Quantitative Methodology
							Measurement/ Objective Criteria	
Panisset	1988	I	MTO	S, NC	IC, US	PO, D	MRP	MMRP
Perry	1991	I	MTO	M	FC	MP	MLL	Survey
Krupp	1993	I	MTS	S, NC	IC, US	MP, D*	MRP	MMRP
Gupta and Taleb	1994	DS	MTS	S, NC	IC, KS	MP, D	MRP	RMRP
Clegg, Williams, Uzsoy	1995	I	MTS	S, NC	IC, KS	MP, D	Max Profit(1)	LP
Hoshino, Yura and Hitomi	1995	I	MTS	S, NC	IC, KS	MP, D	MC	GP
Guide	1996	I	MTO	S, NC	FC, US	MP, ST	MC(1)	SIM, DBR
Guide	1997	I	MTO	S, NC	FC, US	MP, ST	MC(2)	SIM, PDR, DBR
Guide and Srivastava	1997a	I	MTO	S, NC	FC, US	MP, ST	MC(3)	SIM, MMRP, PDR, ORS
Guide and Srivastava	1997b	I		S, NC	IC, KS,SY	MP, ST	MC(4)	SIM, MMRP
Guide, Kraus, Srivastava	1997	I		S, NC	IC, US	MP, ST	MC(5)	SIM, PDR, DRM
Guide, Srivastava, Kraus	1997	I		S, NC	IC, US	MP, ST	MC(5)	SIM, PDR
Guide and Spencer	1997	I	MTO	S, NC	FC, US	MP, D*	MRP	RCCP, MBOM, MBOR
Guide, Srivastava, Spencer	1997	I	MTO	S, NC	IC, US	MP, ST	MIN Δ CAP	SIM, RCCP
Taleb, Gupta, and Brennan	1997	DS	MTS	M, PC	IC, KS	MP, D	MIN #, MRP	RMRP
Taleb and Gupta	1997	DS	MTS	M, PC	IC, KS	MP, D	MRP, Min H	RMRP, HR
Guide and Srivastava	1998	I	MTO	S, NC	FC, US	MP, ST	MC(6)	SIM, DRM
Guide, Srivastava, Kraus	1998	I	MTO	S, NC	FC, US	MP, ST	MC(5)	SIM, PDR
Kizilkaya and Gupta	1998	DS	MTS	M, PC	IC, KS	SP, ST	MC(9)	SIM, DBR(FKS)
Veerakamolmal and Gupta	1998	I	MTS	M, PC	IC, AS	SP, D	MC(8)	HR
Guide, Jayaraman and Srivastava	1999	I	MTO	M, NC	FC, US	MP, ST	MC(7)	SIM, DRM
Ferrer and Whyback	2001	I	MTS	M, PC	IC, KS, SY	MP, D	Min #O	MMRP, RMRP, LP
Inderfuth, de Kok, and Flapper	2001	I	MTS	S, NC	IC, KS	MP, ST	Min R+H+Sh+DI	SDP
Neuendorf, Lee, and Kiritsis	2001	DS		S, PC	IC, KS	MP, D	Min #	PNets
Kongar and Gupta	2002	DS		M, PC	IC, KS	MP, D	Max Profit(5), Max M, Min NDIS, Min H, Min CD, Min CAD	GP
Lambert and Gupta	2002	DS	DTO	M, PC	IC, KS	MP, D	Max. Profit(2)	MIP
Lee, Xirouchakis, Zust	2002	DS		S, NC	FC, KS	MP, D	Min. P+H+D	IP
Souza and Ketzenberg	2002	I	MTO	S, NC	FC, US ⁵	MP, ST	Max Profit(3), Min FT	Q, SIM
Souza, Ketzenburg, and Guide	2002	I	MTO	S, NC	FC, US	MP, ST	Max Profit(4), Min FT	Q, SIM, HR

Reference	Year	Operations Focus	Production Strategy ³	Product-Related	Process-Related	Work Schedule Related ⁴	Performance Measurement/ Objective Criteria	Quantitative Methodology
Voutsinas and Pappis	2002	I		M, NC	IC, KS	MP, D	Max V	HR
Kim, Kee, Xirouchakis, Zust	2003	DS		M, PC	IC,KS	D, MP	Min S+D+H	HR, IP, LPR
Lee and Xirouchakis	2004	DS		S, NC	IC, KS	D, MP	Min. P+S+D+H	HR
Lee, Kim, Choi, Xirouchakis	2004	DS		S, M, PC, NC	IC, KS	D, MP	Min. P+S+D+H	IP
Brander and Forsberg	2005	DS		M, NC	IC, KS	D, MP	Min. S+H	HR
Guide, Souza, van der Laan	2005	I		M, NC	FC	MP,ST	Min. ST	SIM
Luh, Yu, Soorapanth, Khibnik, and Rajamani	2005	I	MTO	M,NC	FC, KS	SP,ST	Min TPC+EPC+H	SDP, SIM
Inderfurth and Langella	2006	DS	DTO	M, PC	IC, KS	SP, D, ST	Min C+P+DI	MIP
Jeon, Kim, Kim, and Lee	2006	DS		S, NC	FC,KS	MP, D	Min D +H	IP, HR
Kim, Lee, Xirouchakis	2006a	DS		M, PC	IC, KS	MP, D	Min. S+D+H	HR,LP,DP
Kim, Lee, and Xirouchakis	2006b	DS		S, NC	FC, KS	MP, D	Min. S+D+H	IP, HR
Kim, Lee, and Xirouchakis	2006c	DS		S, NC	IC, KS	MP, D	Min. S+D+H	PA
Kim, Lee, Xirouchakis and Kwon	2006d	DS		S, NC	IC, KS	MP, D	Min S+H	IP, B&B, HR
Kongar and Gupta	2006	DS	DTO	M, PC	IC,KS	SP, ST	Min. S+H, Max. M, Min. CD, Min NDIS, Max. Profit, Min CAP	FGP
Stanfield, King, and Hodgson	2006	I		M, NC	IC, KS	SP? ST	Min MS	HR
Tang and Teunter	2006	I		M, NC	IC, KS	SP?,MP, D	Min S+ H	MIP
Langella	2007	DS		M, PC	IC, KS	MP, D	Min P+D+H+DI	HR
Barb-Guitierrez and Gupta	2008	DS		M, NC	IC, KS	MP, D	Min. S+O	RMRP
Raut, Gupta, and Swami	2008	I		M, NC	IC, FC, KS	SP,MP, D	Max V	HR
Teunter, Kaparis, Tang	2008	I		M, NC	IC, KS	SP,MP, D	Min S+H	MIP
Teunter, Tang, Kaparis	2009	I		M, NC	FC?, IC, KS	MP, D	Min H _s +H _r +S _p +S _r	HR
Kim, Lee, Xirouchakis, Kwon	2009	DS		S, NC	IC, KS	MP, D	Min S+H	IP

¹ Three series of runs were made each for a single, but increasingly complex, product structure.

² The process sequence is established for each new product before the disassembly operation begins.

³ Blank cells under the Production Strategy column indicate that the production strategy is not explicitly stated nor can be clearly assumed.

⁴ The deterministic versus stochastic classification here refers only to the operation times; other elements can be stochastic (product arrivals, product yields, market demand, etc.), however we focus here only on task times.

⁵ The remanufacturing sequence is known, however, the mix of remanufactured and newly purchased cores is unknown making the average lead times (and thus service levels) uncertain.

Operations Focus:

DS = Disassembly
RE = Remanufacturing/Repair
RA = Reassembly
I = Integrated

Production Strategy:

MTS = Make-to-stock
MTO = Make-to-order
ATO = Assembly-to-order
DTO = Disassembly-to-order

Product-Related:

S = Single Product
M = Multiple Product
PC = Part Commonality
NC = No Part Commonality

Process-Related:

IC = Infinite Capacity
FC = Finite Capacity
KS = Known Sequence
AS = Adaptive Sequence
US = Uncertain Sequence
SY = Stochastic Yield

Work Schedule Related

PO = Project Oriented
SP = Single Period
MP = Multiple Periods
D = Deterministic Task Times
D* = Task times are deterministic, but multiple BOMs account for varied component recovery and usage
ST = Stochastic task times

OBJECTIVE FUNCTIONS**MRP/RMRP-Related**

MRP = Right quantity, right time

Min # = Min. number of root items used to satisfy demand

Min #O = Min number of cores purchased

WIP = Min WIP

MLL = Min lot sizes and lead times

CS = Completion to schedule

Performance- Related

Max = Max throughput

Min. FT = Min flowtime

Min. Δ Cap = Min. actual – estimated capacity level deviations

MC = Multiple criteria

MC(1) = Minimize CS, Min. WIP, Max throughput, Min. FT

MC(2) = Min. (FT, Min. lateness, % of parts expedited, % tardy), Max throughput

MC(3) = Min. WIP, tardiness, FT, Idle time, Max throughput

MC(4) = Min. (% stockout, safety stock level)

MC(5) = Min. (FT, tardiness, % tardy, root mean square tardiness)

MC(6) = Min. (FT, lateness, reassembly delay)

MC(7) = Min. (FT, root mean square tardiness, % tardy)

MC(8) = Min. (Machine idle time, makespan)

MC(9) = Min. (Completion time, shortages, and WIP)

Min. NDIS = Min number of disposed items

Min. H = Min number of stored items

Min ST (sojourn or turn-around time)

Min MS = Min mean and maximum makespan

Economic –Related**Min Cost**

Min H = Min holding cost

Min. S+H = Min. costs (set-up + holding cost)

Min. D = Min. disassembly costs

Min. D+H = Min. costs (disassembly + holding)

Min. S+D+H = Min. costs (set-up + disassembly. + holding)

Min. H+Sh+DI = Min costs(holding + shortage + disposal)

Min. P+S+D+H = Min. costs (purchase + set-up + disassembly + holding)

Min. E(P+D+DI) = Min. expected costs (purchase + disassembly + disposal)

Min. P+D+H+DI = Min costs(procurement + disassembly + holding + disposal)

Min. C + P + DI = Min. costs (core acquisition + leaf procurement + disposal)

Min R+H+Sh+DI = Min costs (remanufacturing + holding + shortage + disposal)

Min CD = Min cost of disposal

Min CAP = Min cost of preparation

Min $H_s+H_r+S_p+S_r$ = Min costs (serviceable and recoverable part inventories and manufacturing and remanufacturing set-ups)

Max Profit, Sales, Total Cost Savings, Value of Jobs

Max Profit(1) = Max (revenue from new and remanufactured products) – (inventory holding cost of returned products, reused modules, partially disassembled products, finished remanufactured products, and finished new products + waste disposal costs + partial disassembly costs + total disassembly costs + assembly costs of remanufactured and new products)

Max Profit(2) = Max (component resale revenue – disassembly cost – disposal cost)

Max Profit(3) = Max (revenue – core acquisition cost – processing cost – disposal cost)

Max Profit(4) = Max (revenue from “as-is” and remanufactured products – costs of core acquisition, remanufacturing

Max Profit(5) = Max profit (revenue from recycled materials and components) – (costs of take back, all transportation, preparation, destructive and non-destructive disassembly, recycling, storage, and disposal)

Max TCS = Max (total cost savings) = purchased cost – remanufactured cost

purchased cost – (set-up cost + operation cost + idle cost)

Max. M = Max material sales

Max V = Max total value of jobs

QUANTITATIVE METHODOLOGIES

MMRP = Modified Materials Requirements Planning

RMRP = Reverse Materials Requirements Planning

LP = Linear programming

IP = Integer Programming

MIP = Mixed Integer Programming

B&B = Branch and Bound

NLP = Nonlinear Programming

GP = Goal Programming

Q = Queuing Theory

SIM = Computer Simulation

RCCP = Rough Cut Capacity Planning

PNets = Petri Nets

DBR = Drum-Buffer-Rope

DBR(FKS) = Drum-Buffer-Rope with Flexible Kanban System

PDR = Priority Dispatching Rule

ORS = Order Release Strategy

DRM = Dispatching Release Mechanism

MBOR = Modified Bill of Resources

MBOM = Modified Bill of Materials

DP = Dynamic Programming

SDP = Stochastic Dynamic Programming

LPR = Linear Programming Relaxation

FGP = Fuzzy Goal Programming

HR = Heuristic

IGP = Integer Goal Programming

PA = Polynomial Algorithm

THE CUMULATIVE EFFECT OF RELIABILITY FAILURE ON CUSTOMER PERCEPTION

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ABSTRACT

Most previous research on service reliability has treated reliability as a service quality dimension that can be measured at a particular point in time via scaled survey items. In contrast to this popular approach, this paper will propose a longitudinal method for capturing the cumulative effects of service reliability failures on customers' perceptions. The proposed method will integrate reliability concepts from the production operations literature and the service quality literature. In addition, the method will offer a framework for classifying reliability failures.

Key Words: Service reliability, failure analysis, service errors

INTRODUCTION

Sooner or later every service experiences some type of reliability failure - even if the service company is usually very dependable. If a customer believes that he or she has always received dependable service from a company prior to a reliability failure then the customer may view the service error as an anomaly [6]. In this case, the customer's confidence in the service will remain unaffected. However, if the customer's prior history with the company includes several episodes of unreliable service, then the customer may not be as likely to dismiss the current reliability failure. In fact, the current failure may contribute to a negative cumulative effect of the entire series of service errors on the customer's perception of service reliability. This negative cumulative effect may eventually become so great that the customer decides to defect to a competitor.

To reduce the possibility of customer defections, service managers should try to understand the ramifications of every lapse in service reliability, even the seemingly minor ones. Despite this need, the service management literature provides managers little guidance on this topic. Most previous research has examined service reliability as a service quality dimension that can be measured at a particular point in time via scaled survey items. In contrast to popular "snapshot" methods for examining perceived reliability, this paper will propose a longitudinal approach to capturing the cumulative effects of service reliability failures on customers' perceptions. The proposed approach will integrate reliability concepts from the production operations literature and the service quality literature. In addition, the approach will offer a framework for classifying reliability failures.

This paper is organized as follows. The following section will summarize key findings from both operations focused studies and customer satisfaction studies of service reliability. Section 3

will integrate these findings in a single model of the cumulative effect of reliability failure on customer perceptions and will offer a failure classification framework that can be used in conjunction with the proposed model. The final section of this paper discusses the managerial implications of the approach and possible avenues for future research.

LITERATURE REVIEW

Service reliability may be defined as the firm's ability to provide a specific service without the need for corrections [5] [23] [1] [17]. This ability is essential for a successful service operation. Not only is reliability one of the most influential components of service quality [14] [1], past research has linked increased reliability to higher customer retention rates, greater customer loyalty, positive word of mouth communication and better business performance [20] [1] [11] [4] [10] [16].

The service management literature contains two distinct groups of empirical studies of service reliability. The first group consists of various applications of the reliability tools commonly used in manufacturing operations. These papers can be said to exhibit an operations focus. The second group of papers utilizes survey items to capture customer perceptions of service reliability. These papers can be said to illustrate a customer satisfaction focus. Both groups of papers furnish valuable insight on the issue of service reliability.

In general, the operations-focused studies provide insight on service reliability in three fundamental ways: 1) they underscore the importance of counting the number of failures in service delivery, 2) they illustrate that a customer may experience a number failure points in service delivery and 3) they reveal that the effect of service reliability failures is cumulative.

In their application of failure rate analysis at a university office, Gunes and Devici [7] modeled service reliability as a function of the total count of weighted failures at a single stage. They argued that due to the non-continuous nature of many service operations, the number of failures is more relevant to service reliability analysis than the timing of the failures. Gunawardane [6] later extended the Gunes and Devici [7] model of failure rate analysis to a multi-stage service process.

In devising this extension Gunawardane [6] noted that a process perspective of service reliability must be utilized to capture the complexity of service delivery. The process perspective views service delivery as a series of stages – rather than as a single stage. Since each stage is potentially a point of service failure, the reliability of each stage must be incorporated into a model of overall service reliability. If a customer experiences several service failures while moving from stage to stage, the combination of multiple reliability failures produces a “snowball” effect that can lead undesirable consequences [22, p. 70] [19]. Likewise, if a customer has experienced a series of services failures over several visits to a service, the cumulative effect of these bad experiences will tend to worsen as the number of bad service encounters increases. At some point, the long term or cumulative effect of unreliable service may drive the customer away.

In contrast to operations-based studies of reliability, customer-based studies analyze customers' responses to survey questions to assess customers' perceptions of service reliability. The SERVQUAL studies were the first to address the issue of service reliability from the customer's perspective. Parasuraman, Zeithaml and Berry [17] [18] developed a model for consumer perceived service quality which included a five-item reliability measure. The five items in the reliability scale were "(1) providing services as promised; (2) dependability in handling customer service problems; (3) performing services right the first time; (4) providing services at the promised time; and (5) maintaining error-free records" [6 p. 586]. Many researchers have incorporated these SERVQUAL reliability items in surveys of service quality. For instance, Kworthnik [13] used SERVQUAL to study the hotel industry and found that in lodging, (1) tangibles were the most important dimension of service quality, (2) the tangibles dimension and the reliability dimension tended to overlap and (3) responsiveness and empathy seem to be less important dimensions of service quality than reliability.

The customer-based studies provide insight on service reliability in two ways. First, they model reliability as a construct composed of several factors that can affect the customer's perception of service reliability. Second, they help to reveal the degree of customer satisfaction or dissatisfaction that exists for each of the factors and thus enable a service manager to identify which factors could be negatively affecting customers' perceptions of reliability.

Although both the operations-based studies and the customer-based studies offer valuable insight on service reliability, they do so from different perspectives, utilize different analytical methods and provide different types of information to the manager. The operations-based studies show that an operations approach to service reliability underscores the importance of the cumulative effect of reliability failures over time; however, this approach does not capture the customer's perceptions of service failure. In contrast, the customer-based studies illustrate that a customer satisfaction approach to service reliability can reveal customer perception at one point in time but it fails to address the cumulative effect of service failure over time. Thus, each approach, taken separately, provides only a partial perspective of service reliability. Needed is a method to integrate both approaches so that a more comprehensive view of service reliability can be developed. The following section will propose such a method.

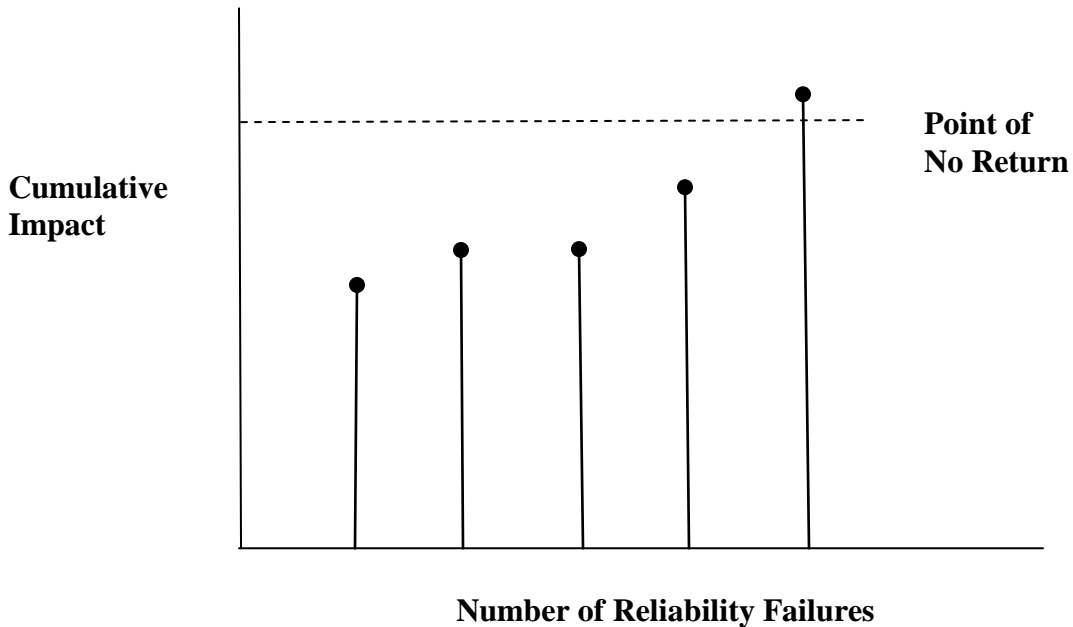
INTEGRATING THE OPERATIONS-BASED AND CUSTOMER-BASED APPROACHES

The preceding discussion illustrates that any method that integrates the operations-based approach and the customer-based approach to service reliability must accomplish the following: 1) count the number of reliability failures a customer experiences over time, 2) help the manager gauge the relative effect of each individual reliability failure, 3) help the manager assess the cumulative effect of reliability failure over time and 4) utilize customer feedback on actual failures to gather information about the first three features.

Figure 1 presents a graphical method for representing the first three requirements. While this graph can be used to depict the cumulative effect of poor reliability during a single service encounter, it is especially useful as a tool for longitudinal analysis of service reliability. When used this way, the cumulative effect of reliability failure is a non-decreasing function of the total

number of customer perceived reliability failures over a series of past service encounters. Thus, with each successive failure, the perceived unreliability of the service either increases or, at best, remains at the same level.

FIGURE 1
RELATIVE IMPACT OF CONSECUTIVE RELIABILITY FAILURES



The service manager must use the customer’s perspective in constructing and interpreting this graph. In particular, the manager must be able to gauge the relative impact of any service failure from the customer’s viewpoint; otherwise, it would be impossible to understand how rapidly the cumulative effect is changing. To give a manager this needed insight, it is useful to classify reliability failures along two dimensions. The first dimension involves the perceived severity of the individual service failure. The second dimension deals with responsibility for the reliability failure.

Severity of service failures may be defined as the “magnitude of loss that customers experience due to the failure” [8, p. 132]. Various studies have developed measures for severity of service failures usually ranging from minor to major [9] [8] [3]. In this study severity of service failure is defined as either minor or severe using the model proposed by Hoffman, Kelley and Rotalsky [9]. A minor failure is one that may cause delays or changes to the service but which can be corrected and allow the service to continue to completion. A major failure is one that prevents the service from being completed or results in a negative conclusion on the part of the customer.

Some service failures result from employees’ errors while others stem from customers’ mistakes [2]. Since the service failures themselves can range from minor to severe, four possible combinations of failure severity and responsibility may occur in practice. These include: 1) minor failures for which the customer is to blame, 2) major failures for which the customer is

responsible 3) minor failures for which the provider is to blame and 4) major failures for which the provider is responsible. Figure 2 summarizes these four possible combinations.

**FIGURE 2
A SERVICE RELIABILITY FRAMEWORK**

Severity of Service Failure	Major	II	IV
	Minor	I	III
		Customer	Provider
		Responsible for Failure	

Each type of failure classified in Figure 2 affects customer perception in different ways. Obviously, severe errors made by service workers will have a greater impact on customer perceptions than will minor worker mistakes. In contrast, interpretation of the effect of customer error is not as straightforward. When a service reliability failure occurs, the customer frequently blames the service provider for causing it [21] [15], even if the customer is actually responsible for the problem. Although this tendency is a common one, there are certain instances when the customer accepts blame for his mistakes. These instances are associated with skill-based errors made by the customer [21] [12].

A skill based error is a mistake made in completing a “common activity in routine situation” [21, p.242]. For instance, forgetting to leave one’s car keys in the car before the car is serviced at an auto repair shop is an example of a skill-based error. Unbuckling your seat belt on an airplane before the plane comes to a stop at the gate is another example. Skill-based errors made by the customer do not produce dissatisfaction with the service quality [21] [12]. Thus, these types of errors have no effect on customer perceived reliability. On the other hand, rule-based errors made by customers do affect perceived reliability. A customer makes a rule-based error when he or she incorrectly applies familiar scripts or responses to a service situation. For instance, a restaurant customer may incorrectly assume that a waitress will collect the payment for the bill at the table and then discover that he must pay for his meal at the register. Even though the customer made the mistake, he will blame the waitress for the inconvenience.

DISCUSSION

This paper has argued that the customer's perspective of service reliability must be integrated with a longitudinal, operations-based approach to reliability analysis. To achieve this sort of integration, the service manager first must consider what type of data to collect and then how to organize and interpret the data so that the possibility of future customer defections due to reliability failures can be reduced.

Improved data collection is the starting point for improved reliability analysis. A fundamental managerial implication of this paper is that the service manager cannot simply use a few Likert-scaled items to gauge the cumulative effect of poor reliability on customer perceptions. Instead of adopting this rather limited "snap shot" approach, the manager could use open ended survey questions to obtain information about the specific reliability failures a customer has experienced. It is important to ask the customer such questions as: "Has this problem happened before? If so, how many times?" and "Whose fault was it and why?" A customer's responses to these types of open-ended questions give a manager an idea how close that particular customer may be to defecting. For instance, if a customer recalls a series of series of rule-based errors, then the manager can be fairly certain that the cumulative effect of reliability failure has been steadily increasing over time for this customer. In this case, the customer may be closing in on the "point of no return" illustrated in Figure 1.

Instead of focusing on the experiences of a single customer at a time, a manager may wish to organize the data by the classification framework illustrated in Figure 2. In this case, the manager will want to use Pareto analysis to determine the relative frequency of the different types of service errors. This sort of approach will help the manager frame suitable failsafe techniques to prevent mistakes from occurring in the first place as well as lessen the impact of an error once it is made. Obviously, the fail-safe techniques must be tailored to the type of error that occurs. In particular, the manager must consider how to help his customers avoid the various rule-based errors they make since the customer will blame the service rather than themselves for these errors.

Since the types of rule-based errors a customer makes will vary with the service context, future research could include applications of this approach in several service settings. In each of these settings, it would be interesting to investigate the relative impact of customer error on perceived reliability compared to the effect of worker based error. In addition, customer data from these actual service contexts could be used to examine the various patterns through which the cumulative effect emerges.

In summary, the analytical approach proposed in this study represents only an initial step in the investigation of the cumulative effect of reliability failure on customer perceptions. However, the proposed model does help the manager view reliability as a service feature that must be tracked and managed over time. Such a perspective can potentially reduce customer defections due to unreliable service.

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AN ANALYSIS OF INLAND LOGISTICS CLUSTERS

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Abstract

Transportation and logistics have become increasingly important to many organizations today. The global nature of supply chains makes performance in the transportation and logistics areas extremely important for overall company performance. Private and public initiatives have led to the development of “logistics clusters” in many locations both domestically and internationally. The rationale behind “logistics clusters” is that larger developments focused on logistics can be more economical and more efficient when compared to independent widely dispersed logistics facilities. Logistics clusters may be located in connection with an ocean port or in another configuration as an “inland port”. This paper will analyze the latter of these two options. Several examples of “inland ports” or “inland logistics clusters” will be discussed and the major factors contributing to the successful initiatives will be presented.

Introduction

The global supply chain is a frequently discussed topic today because it has become the standard operating mode in actual practice in the international business world. In order to move materials or products through a global supply chain from the Far East to North America or Europe a multitude of handoffs are required [16] and the various logistics elements must function effectively to achieve an acceptable level of delivery performance.

Among these handoffs are multiple modes of transportation which are utilized. The term “intermodal” is used to describe “the transfer of products involving multiple modes of transportation – truck, railroad or ocean carrier” [9]. Items shipped in containers by ocean carrier must be transferred to rail or truck. Those items shipped in containers by rail must be transferred to truck in order to reach the ultimate destination. The common fundamental elements of intermodal transportation are really the truck and the container.

“Intermodal is growing faster than any other [single] mode of transportation” [9]. Despite the growth of intermodal and partially because intermodal does rely on trucks – “trucks are still the single most-used mode to move freight, especially for distances less than 500 miles” [19]. Trucks “moved 69 percent of the weight and 65 percent of the value in 2007” [19]. Intermodal is credited with moving “18 percent of the value of freight transportation in 2007 and is forecast to grow to nearly 27 percent by 2040” [19].

Intermodal has two variations, Container on Flatcar (COFC) as described above and Trailer on Flatcar (TOFC) which involves a regular trailer from an eighteen-wheeler is loaded on the railcar. Prior to 1992 TOFC accounted for more than half of the intermodal shipments. Around 1992 TOFC and COFC were about equal. Since 1992 COFC has grown to a dominant majority of the intermodal shipments [12]. This can be seen in the fact that 84.9% of all rail intermodal consists of COFC which is labeled as “Total

Container Traffic”. The following table contains statistics for these options for the most recent years with data available:

Table 1: Intermodal Statistics

	2007	2008
Total Rail Intermodal Traffic	14,078,952 moves	13,659,495 moves
Total Container Traffic	84.8% of all rail intermodal moves	84.9% of all rail intermodal moves
Domestic Containers	3,598,006 or 25.5% of total moves	3,849,327 or 28.2% of total moves
International Containers (20-ft, 40-ft and 45-ft)	8,335,480 moves; approximately 59.2% of total	7,749,769 moves; approximately 56.7% of total
Trailers (within Intermodal)	2,145,466 or 15.2% of total moves	2,060,399 or 15.1% of total moves

Sources: [10][11]

Around the world, new logistics configurations to improve performance have been proposed and implemented with varying degrees of success over the past 20 to 30 years. Intermodal terminals and airports play major roles in these logistics locations along with distribution centers. The names for the configurations include freight villages [2], Cargo Transport Centers in Germany [2], and logistics clusters [17].

Research on “Freight villages” have described the subject locations as having the following features multiple “transportation modes, intermodal facilities and associated traffic, operating entity, transport and logistics services provided, [types of] companies located in the facility including transport and logistics companies, public and private services, warehouse space available, office and parking space, accessibility, investment made” [2].

“Several facilities in Europe started through political incentive to promote employment, suburban development, intermodality, urban congestion mitigation, reorganization of the freight transport sector, load sharing and bundling. The idea was to provide a neutral platform to attract companies, to benefit from synergies between them, and create an integrated business community with transportation and logistics services. The main idea is that concentration of transport and logistics activities in larger infrastructures is more economic and efficient than several smaller intermodal terminals scattered over the territory” [2].

“Cargo Transport Centers” is the preferred terminology in Germany but the description and characteristics are very much the same as described above [2]. In general terms, Sheffi described “logistics clusters” as a city, region or even a state where a large number of companies and facilities have located with the main focus being logistics, supply chain and transportation [17].

The necessary infrastructure includes an ocean port, airport, major highway, or intermodal transportation “hub.” The term “logistics clusters” will be adopted for this paper as being the more generic term of the many options available.

Example Logistics Clusters

In general, ocean ports such as Singapore and Rotterdam, Holland are examples of logistics clusters on a grand scale. These locations are very special because it is difficult to emulate or recreate comparable logistics clusters in other regions for a variety of reasons. Deep water ports require a huge investment for infrastructure, for dredging and for ongoing upkeep. Major contracts with shipping companies are also needed to make a deep water port viable. Public buy-in is also a critical factor given the current public attitudes regarding the environment and a host of related issues when new ocean-side or waterfront developments are proposed.

Inland ports or inland logistics clusters offer many of the same economies and efficiencies as the large ocean ports. In many cases the negative aspects are short-circuited because the environmental concerns are less of an issue (e.g. locating where there are no wetlands). To further understand the concept of inland logistics clusters this section will next present brief descriptions of several examples of inland logistics clusters that have developed in the last two decades.

For this paper, four logistic clusters have been selected for discussion:

- Alliance Logistics Park in Texas
- CenterPoint Intermodal Center in Illinois
- The Port of Huntsville in Alabama
- Virginia Inland Port in Front Royal, Virginia

Alliance Logistics Park

The Alliance Logistics Park in Texas is the largest of all the logistics clusters to be discussed. This location is also an example of several different factors coming together to make the development possible. First, the existing railyards in Dallas were located in a very congested area so the Class I railroads were looking outside of Dallas to have more space. Burlington Northern Santa Fe (BNSF) played a leading role in selecting a location northwest of Dallas, north of Ft. Worth and in close proximity to Dallas/Ft. Worth (DFW) International Airport [1]. Union Pacific (UP) railroad developed their own intermodal rail terminal at the Alliance Park and the Fort Worth Alliance Airport was built as the world's first industrial-focused airport [1].

BNSF has reached a total of 600,000 container lifts on an annual basis and is projected to grow to 1 Million lifts per year [1]. The rail provides import/export connectivity to the West Coast ports with direct connections to Asia through those ports. The volume at the BNSF intermodal facility at Alliance is transported by 13 double-stacked intermodal trains daily [1].

Hillwood Properties of Fort Worth is the major real estate developer for Alliance Park with substantial financial support as "A Perot Company" [13]. The original 11,000 acres has subsequently expanded to a total of 17,000 acres for the entire Alliance development [13]. Approximately 4,000 acres have been developed with additional work underway [13].

A long list of third party logistics (3PLs) providers and freight forwarder companies are located at Alliance including:

- AmeriCold Logistics
- BNSF Railway
- Con-way Freight
- FedEx Southwest Regional Hub
- Ryder Integrated Logistics
- Greatwide Distribution
- Trans-Trade, Inc., and
- UPS Supply Chain Solutions [1].

CenterPoint Intermodal Center

CenterPoint is another property development company and we focus here on the Illinois development in Elwood or the Joliet region. The CenterPoint site has 2,500 acres and has room available to build up to 12 million square feet for transloading, distribution and/or warehousing [3]. BNSF and UP again have shared the intermodal duties at this logistics cluster. The BNSF Logistics Park – Chicago occupies 770 acres for their intermodal park. The overall size is 10,000 acres for the two pieces of development – one associated with BNSF and one associated with UP.

Major tenants at CenterPoint Intermodal Center – Elwood include:

- BNSF Railroad
- Wal-Mart Stores, Inc.
- DSC Logistics
- Georgia Pacific
- Potlatch
- Sanyo Logistics, and
- Maersk [3].

CenterPoint Properties again represents a real estate developer with substantial financial backing. CenterPoint is a wholly owned subsidiary of CALPERS (the California State Employees Retirement System). CenterPoint has other logistics cluster developments around the country including: Savannah, Georgia; Houston, Texas; Suffolk, Virginia and several others [4]. The company also made a bid in 2009 to take over the management of the Virginia ports in Hampton Roads with an offer to pay approximately \$4 Billion initially for 60 years of control [5][8]. That proposal resulted in competing bids but the Virginia Port Authority has retained control of the Virginia Ports to this date [6].

Port of Huntsville

The Port of Huntsville is comprised of three closely related facilities: Huntsville International Airport, the International Intermodal Center (IIC), and the Jetplex Industrial Park in Huntsville, Alabama [7]. The IIC is named for J.E. Mitchell, Jr., the first executive director of the Port of Huntsville [7]. Mitchell played a key role in developing the master plan for multimodal vision for the Port of Huntsville. That vision was to build a multimodal facility which offered the widest range of transportation options for moving freight [7].

The original intent behind the development of the Port of Huntsville and IIC was to “offer access to as many modes of freight transport as possible within a single facility. The key to realizing this goal, particularly for a location lacking direct seaport access, is attracting substantial airfreight operations. Air cargo was a primary goal of Huntsville planners throughout the facility’s development process” [15, p. 39].

The IIC and the Jetplex Industrial Park occupy 6,000 acres of the available 10,000 acres for the overall complex [7]. The Jetplex Industrial Park first opened in 1974 and now has grown to contain 60 different tenants, USDA inspectors located on-site, U.S. Customs services available 24 hours per day, several freight forwarders and Foreign Trade Zone designation [7]. Among the occupants of the Jetplex are: Panalpina (a European freight company), FedEx, BAX/Schenker, Cargolux, Atlas Air, UPS Supply Chain Solutions, and UPS, Inc. [7]. In 2009, the IIC completed a \$7 million, 92,000 square-foot air cargo building which closely matches a 100,000 square-foot building which Panalpin has occupied since 1990 [7].

Rail service at IIC is provided by Norfolk Southern for domestic and international containers [15]. The railyard consists of four parallel track with more than six miles of track to provide ample room for intermodal rail transfer operations [15]. The IIC also has rail-mounted cranes and rubber tire cranes which provide access to any location in the 45-acre railyard [15].

Virginia Inland Port

The Virginia Inland Port (VIP) is served by Norfolk Southern Railroad with trains arriving daily, Monday through Friday [18]. The trains are dedicated to container shipments arriving by ocean freight in the Virginia Port in Hampton Roads (Norfolk, Portsmouth, and Newport News) and moving in the direction of the final destination somewhere in the mid-west or northeast by traveling by rail to the VIP in Front Royal, VA [18].

VIP is a great example of forward thinking on the part of the Commonwealth of Virginia because the initial concept dates back almost 25 years. The inland port was also put in place very quickly with initial operation of VIP occurring in 1989. As with other similar logistics clusters, the VIP was motivated by the desire to reduce congestion near the Virginia Ports in Hampton Roads. The other motivation was to increase international shipments for both imports and exports through the Virginia Port. By most accounts, these objectives have been achieved at a high degree of success over the 22 year operation of VIP [14]. The following examples will provide some evidence of that success.

The VIP occupies 52 paved acres of land located within 161 acres of former farmland and requires just 17 employees. The greater benefit has come from the new economic development in the form of companies locating in Warren County or the surrounding counties. Major companies including the Home Depot, Family Dollar and Red Bull energy drinks [18]. The Home Depot distribution center is located in nearby Frederick County and represents a \$25 million investment for a 750,000 square-foot facility and created 125 new jobs [14]. These companies and others are credited with bringing 7,000 jobs to the area surrounding the VIP and an investment of nearly \$600 million in new facilities [18]. In the area, 33 companies have located nearby and 25 of those are outside Warren County where VIP is located [14].

Beyond the VIP property, the development amounts to 1,250 acres of industrial and distribution locations with about 60 percent of that land located between the railroad and Highways 430/522 [14].

In 2008, “the inland port handled 33,607 ocean containers, which was down from 2007, when the facility handled 35,366 containers” [18]. The original objective called for handling 20,000 containers per year at VIP [15]. The growth to a level above 30,000 containers is a favorable indicator for increased import/export activity.

Looking back to the original motivations, the volume at VIP with the container shipments traveling by rail in both directions translates to fewer truck trips in Hampton Roads and across the Commonwealth. Companies locating near VIP and the extended connection to the mid-west attracted export shipments through VIP and through the Virginia Port taking some business away from the Port of Baltimore and the Port of New Jersey. The Home Depot and Family Dollar are examples of increased imports that are destined for the Virginia Port rather than other seaports.

Table 2: Summary Characteristics of Four Logistics Clusters

Factor\Site	Alliance Park, Arlington, TX	Elwood - Joliet, IL	Port of Huntsville, AL	Virginia Inland Port, Front Royal, VA
Acreage	17,000	10,000	10,000	161 at VIP; adjacent 1,250 Industrial
Air	Ft. Worth Alliance Airport	Not part of the logistics cluster	Huntsville International Airport	Not an important element currently; Dulles less than 90 miles
Rail	Two Class I's BNSF & UP	Two Class I's BNSF & UP	Norfolk Southern	Norfolk Southern
Major Highways	I-35, I-20, 30 & 40	I-55 & I-80	I-565, SR72, I-65 & I-24	I-81 & I-66
Connection to Water Port	By rail to Houston	None in close proximity	Distant connections by Rail: Six East coast ports; West coast ports thru Memphis	Direct Rail from Norfolk VA Port; less than 200 miles

Discussion

The most significant finding in the course of this research is the substantial financial backing for two of the logistics clusters. Hillman Properties is the developer of Alliance Park in Texas and Hillman has the backing of Ross Perot as one company within the Perot family of companies. CenterPoint is the developer of CIC-Joliet and CenterPoint has massive financial backing from CalPERS (the California public employees retirement system). The financial backing is reported at different levels ranging from \$3.4 Billion [5] to \$191.4 Billion [6]. CenterPoint has also been reported to be “a wholly owned subsidiary of CalPERS” [8].

CenterPoint has logistics clusters of varying sizes across the country. The following list indicates the size and investment for a few of those locations:

- CenterPoint Intermodal Center - Elwood/Joliet; 2,500 acre site; \$1 Billion investment
- CenterPoint Intermodal Center – Houston, TX; 800 acre site; \$300 Million investment
- CenterPoint Intermodal Center – Savannah, GA; 250 acre site; under development
- CenterPoint Intermodal Center – Suffolk, VA; 921 acre site; \$350 Million investment [5].

These examples and other sites highlight the huge financial assets available for CenterPoint Properties.

Another major financial backer is Warren Buffett through his Berkshire Hathaway and an ownership stake in Burlington Northern Santa Fe (BNSF). BNSF has played a major role in the development of both the Alliance Park and the Elwood-Joliet Park. The presence of BNSF and Union Pacific (UP) in these two locations also contributes to the massive size of those two logistics clusters. The two Class I railroads serve as important “anchor” organizations for these sites.

The Port of Huntsville and the Virginia Inland Port (VIP) had substantial political support locally and statewide for the two respective locations. Supporters of both locations had clear visions as to what the logistics cluster was hoping to accomplish. Huntsville had a clear plan to attract air cargo to mediate the lack of an ocean port. VIP was intended to be an extension of the deep water port in Norfolk and has served that purpose well.

The larger logistics clusters result in greater direct employment and direct economic impact while the smaller logistics clusters depend upon adjacent development and the attraction of companies to nearby locations but not directly on-site. This is particularly true at VIP where the on-site employment is 17 employees but the surrounding areas have benefited from businesses that have brought approximately 7,000 jobs to the region.

The success in these example locations has prompted other states to evaluate possible similar developments. Georgia broke ground on an inland port in Cordele earlier in 2010 [20]. South Carolina has evaluated an inland port in the last eight years [15]. North Carolina launched a task force to evaluate logistics on a statewide basis in 2010 with the inland port model as one of the potential configurations.

Main Factors Revealed for Logistics Cluster Success

From the example locations described above, the main factors which stand out as important success factors are summarized in Table 3 below:

Table 3: Major Factors Contributing to Site Success

	Alliance, TX	Joliet, IL	Port of Huntsville	Virginia Inland Port
Large Financial Backer	Yes	Yes		
Local Backing			Yes	
State Backing				Yes
Participation by Class I Railroad	Yes; Two	Yes; Two	Yes	Yes
Access to Interstates	Yes	Yes	Yes	Yes
On-Site Business Development	Yes	Yes	Yes	
Surrounding Business Development			Yes	Yes
Airport Participation			Yes	
International Shipper Participation			Yes	
Direct Access to Deep Water Port				Yes
Anchor Organization(s)	BNSF & UP	BNSF & UP	Panalpina & Airport	Virginia Port & Norfolk Southern

Summary

By exploring the existing, successful inland logistics clusters we have begun to identify a significant number of factors that contributed to the success for those specific locations. By enumerating the list of factors the intent is to provide other agencies and organizations a checklist to assist with evaluations of future proposed inland logistics cluster locations. This may assist with the decision making process for those individuals making the proposals and the individuals charged with evaluating those proposals.

Future research may expand this analysis to other locations to identify similarities and differences in the factors for a larger group of logistics clusters. Analyzing the data in greater detail for the major companies located in each cluster may also be a fruitful research avenue to gain a deeper understanding for the dynamics in a cluster. Comparing international logistics clusters with domestic logistics clusters would be a third potential extension of this research.

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GLOSSARY

COFC (container on flat car)

The movement of a container on a railroad flat car. This movement is made without the container being mounted on a chassis.

Container

A receptacle that resembles a truck trailer without wheel (chassis) that is lifted onto flat cars. Containers are designed for all modes of intermodal transport. Most containers are 20, 45, 48 or 53 feet in length.

Container Yard

A yard used for storage of containers when not in use. Container yards can be railroad or privately owned.

Double-Stack

The movement of containers on articulated rail cars which enable the one container to be stacked on another container for better ride quality and car utilization.

Inland Carrier

A transportation company which hauls export or import traffic between ports and inland points.

Intermodal

Transport of freight by two or more modes of transportation. Examples are: ship-rail, rail-truck.

Intermodal Terminal

A railroad facility designed for the loading and unloading of containers and trailers to and from flat cars for movement on the railroad and subsequent movement on the street or highway.

Lift

The process of moving a container or trailer to and or from a rail car.

Piggyback

Transportation of a highway trailer on a railroad flat car.

TOFC (trailer on flat car)

A rail trailer or container mounted on a chassis that is transported on a rail car. Also known as piggyback.

Well Car

An intermodal flat car that was specifically designed to place one container on top of another better utilization and economics. Referred to as a well car because the cars are depressed in the center to allow clearance of the double stacked containers when moving under low-lying structures.

Source: http://test.intermodal.org/statistics_files/Intermodal%20Glossary.html

EXPLORING E-COMMERCE USAGE IN LEADING INDUSTRY SUB-SECTORS

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Abstract

The use of Electronic Commerce (e-Commerce) has grown steadily in certain industry sectors but not as much in other sectors. The use of e-Commerce in the overall Manufacturing sector and the dominance of business-to-business (B2B) over business-to-consumer (B2C) can be demonstrated by analyzing statistics for the most recent six years from the U.S. Census Bureau. In this paper the leading manufacturing sectors in B2B usage will be identified and explored in more detail. The goal of this research is to identify industry sector characteristics that contribute to greater use of e-Commerce transactions as exhibited by the leading industry users.

Introduction

E-Commerce is commonly divided into two categories: business-to-business (B2B) or business-to-consumer (B2C). B2B is characteristically related to manufacturing and wholesale industries while B2C is typically associated with retail industries and other service industries.

According to data from the U.S. Census Bureau for the most recent eight year period, U.S. Shipments, Sales and Revenues attributed to e-Commerce more than tripled from \$1,062 Billion in 2000 to \$3,704 Billion in 2008. In fact, e-Commerce grew at more than twice the rate of the Shipments, Sales and Revenues themselves (i.e. a 348.8% increase in e-Commerce versus a 152.9% increase in Shipments, Sales and Revenues) [30]. The category of Business-to-Business (B2B) e-Commerce applications was the main contributor to this growth with Manufacturing and Wholesale B2B accounting for more than 92% of the e-Commerce total in each of the nine years [30]. The Business-to-Consumer (B2C) e-Commerce applications which are characteristic of retail and online marketers accounted for a much smaller portion reaching \$288 Billion in 2008 which translates to 7.8% of the total e-Commerce Shipments, Sales and Revenues in the U.S for that year [30]. The growing use of e-Commerce in the Manufacturing sector and the dominance of B2B over B2C are both very clear from this data.

e-Commerce and e-Business

A very basic definition of e-Commerce is “conducting business transactions with suppliers and customers electronically” [18]. Another simple definition states that “e-commerce is defined as the use of the Internet to facilitate, execute, and process business transactions” [15]. From another perspective, e-Commerce is described by Gunasekaran et al. as “an emerging area that encompasses processes directly and indirectly related to the buying, selling and trading of products, services and information via computer networks – including the Internet” and “a range of technologies and practices that are now available to improve the effectiveness of trading relationships” [19].

Lee and Whang define “e-business” as a more specific concept compared to “e-commerce” by stating that e-business is “the planning and execution of the front-end and back-end operations in

a supply chain using the Internet” [21]. This definition is more focused for the e-business transactions which are characteristic of manufacturing and supply chain management. This definition also coincides with the B2B transactions which we use in this paper. For the purposes of this paper we focus exclusively on B2B and we look at the manufacturing industry in much greater detail.

Literature Review

Technology companies such as Cisco and Intel were among the early innovators in B2B e-Commerce. The literature does provide good coverage of these early initiatives. As early as 2001, Cisco processed 90 percent of their sales online [13][3]. This level of online sales has continued through recent years. Cisco also realized \$500 million in savings by redesigning and integrating their processes with supplier and customers [5][3]. Intel reduced their order clerks by hundreds when they converted to an automated online ordering system [11][3].

Iyer, Germain and Frankwick [20] investigated the relationships “among supply chain B2B e-commerce, environmental uncertainty, organizational structure, and time-based delivery performance.” One interesting outcome of their research is that “B2B e-commerce enhances time-based delivery performance” [20]. A second result indicates that internal “integration within the firm [is positively related] with B2B e-commerce implementation” [20].

Auramo, Kauremaa and Tanskanen [3] found that 73 percent of the Finnish firms they surveyed had EDI in use for more than 5 years for purchase orders. For the other responses, 13 percent had EDI in use for 3 to 5 years and 13 percent had EDI in use for less than 3 years [3].

For sales orders, 43 percent of the firms had EDI in use for more than 5 years [3]. The other responses included 33 percent using EDI for 3 to 5 years and 24 percent of the firms using EDI for sales order for less than 3 years [3].

These results are interesting because there is a similar commitment to EDI in the U.S. in certain industries. The automotive industry which is a segment of the Transportation Equipment sub-sector is one example where EDI has been relied upon for a number of years and well beyond the five years as defined in the above research.

Claycomb, Iyer and Germain [20] in a survey of a cross-section of several industries investigated the extent of B2B e-commerce usage. In a sample of 152 firms, the responses were heavily weighted in the direction of “Strongly agree” for the following four statements:

“We have extensively integrated B2B e-commerce into our business processes”

“Our firm uses B2B e-commerce extensively with key partners”

“We use B2B e-commerce in most of our critical business processes”

“We rely extensively on B2B e-commerce” [20].

These results are important for our purposes in this paper because the responding companies represent five out of six of the industry sectors that we have identified as leading users of B2B e-commerce. The following are the number of respondents from five industries:

- Chemicals 40
- Electronics 23
- Food 20
- Industrial machinery 15
- Transportation equipment 10 [20].

These add up to 108 firms from those five industry sub-sectors responding to the research by Claycomb, Iyer and Germain [20]. Based on this number of companies and the survey responses we can infer that this provides supporting evidence for the growth and usage of B2B e-commerce in those five industry sectors. This is also an indication of B2B reaching a more mature level of development when compared to the efforts in 1999-2000.

As this brief literature review indicates, much of the literature on e-Commerce was published during the years from 2000 to 2005. There have been significant real developments beyond those early years and research has provided very little documentation for the progress that has been made. We attempt to provide additional evidence of the growth and usage of B2B e-commerce.

Research Method

The general approach being employed in this paper is a “trend study”. It is customary that “...trend studies often involve a rather long period of data collection. Typically, you do not personally collect all the data used in a trend study but instead conduct a secondary analysis of data collected over time by several other researchers” [4, p. 57]. Given the nature of trend studies, we utilize data from multiple sources and perform additional analysis to better understand the factors that may be contributing to the trends in B2B e-Commerce in the U.S. We are utilizing six years of data from the U.S. Census Bureau and U.S. Department of Commerce. Then we gather additional data about industry sub-sectors and individual companies within each of the sub-sectors.

We also utilize the AMR Research Top 25 Supply Chains (Note: AMR is now part of Gartner) which is published annually as another data source to help understand the trends based on individual company assessments. Then we investigate individual companies as examples of the e-Commerce efforts for each of the sub-sectors. The following section will describe our primary data sources for B2B e-Commerce activity for the Manufacturing sector.

Quantifying e-Commerce Usage

An annual report published by the U.S. Department of Commerce, Economics and Statistics Administration, and the U.S. Census Bureau is known as “E-Stats” [34]. The statistics contained in “E-Stats” are actually taken from five different surveys which focus on the various sectors of the economy. For the Manufacturing sector, two different surveys are utilized: the Economic Census – Manufacturing and the Annual Survey of Manufactures (ASM) [34]. The ASM is a survey which collects a wide range of data from more than 50,000 manufacturing plants in the United States [34].

The U.S. Census Bureau and U.S. Department of Commerce have adopted the term “e-Shipment” as a way to label the e-Commerce transactions. This also distinguishes and separates e-Shipment from all other transactions which are not handled electronically. These statistics are stated in dollar values for shipments which serves as a measure of “usage” for B2B e-Commerce success. Since the statistics contained in the E-Stats reports are aggregated by Industry Group and by Economic Sector, the levels of analysis which are appropriate in this paper will be at the Industry Group level and at the National level.

In 2010, the magnitude of e-Commerce was presented at the Southeast Decision Sciences regional conference [28]. The analysis was focused primarily at the National level and the broad Industry Sector level. One possible future research topic that was proposed was to explore the industry sub-sectors which have shown the highest usage of e-shipment. This paper continues

the stream of research by investigating the leading industry sub-sectors and the factors which have contributed to the growth of e-shipments.

The top six industry sub-sectors were identified which account for a little over 70% of all of the e-shipments from manufacturing industries. These leading sub-sectors for the most recent data from 2008 are:

- Transportation Equipment (NAICS 336)
- Petroleum and Coal Products (NAICS 324)
- Chemical Products (NAICS 325)
- Food Products (NAICS 311)
- Computer and Electronic Products (NAICS 334)
- Machinery Products (NAICS 333)

The following table contains data indicating the dollar value of e-shipments for these top six industry sub-sectors (note the Industry sub-sector name has been abbreviated):

Table 1: E-Commerce (or E-Shipments) Dollar Value

Industry Group	E-Commerce Shipments (Millions of \$)						
	NAICS Code	2003	2004	2005	2006	2007	2008
Transp. Equip.	336	\$327,401	\$346,473	\$381,600	\$383,560	\$411,782	\$360,601
Petro & Coal	324	51,586	77,527	130,869	160,177	195,309	339,652
Chemical Prod.	324	85,186	102,967	173,747	203,168	252,390	296,536
Food Products	311	59,576	64,121	99,090	153,996	203,693	245,706
Computer & Electronics	334	67,476	76,197	113,704	120,947	142,777	151,519
Machine Prod.	333	34,797	52,292	72,390	93,763	111,074	130,251
Total Mfg E-Shipments		842,666	996,174	1,343,852	1,566,799	1,879,424	2,154,483

Source: [34]

To indicate the growth in a different manner we converted the above table to a normalized format using 2003 as the base year at 100 percent. Those results are shown in the following table:

Table 2: E-Commerce (or E-Shipments) Normalized

Industry Group	E-Commerce Shipments (Normalized Data)						
	NAICS Code	2003	2004	2005	2006	2007	2008
Transp. Equip.	336	100%	106%	117%	117%	126%	110%
Petro & Coal	324	100%	150%	254%	311%	379%	658%
Chemical Prod.	324	100%	121%	204%	238%	296%	348%
Food Products	311	100%	108%	166%	258%	342%	412%
Computer & Electronics	334	100%	113%	169%	179%	212%	225%
Machine Prod.	333	100%	150%	208%	269%	319%	374%
Total Mfg E-Shipments		100%	118%	159%	186%	223%	256%

Source: Calculated using data [34]

Transportation Equipment began at a higher level in 2003 and has grown slightly and maintained those gains. There is a small drop off in 2008 given the economic difficulties which affected many companies in this industry group in the second half of 2008.

Petroleum and Coal began at a lower dollar level in 2003 and has grown dramatically in the most recent four years. As indicated in the table above when comparing 2008 with 2003, Petroleum and Coal has shown the largest growth with the 2008 dollar value equating to 658 percent of the 2003 dollar value of e-shipments.

For the Chemical Products group, e-shipments have grown steadily and significantly since 2003. As seen in the table, 2008 was 348 percent of the 2003 value.

Food Products started slowly but has grown significantly beginning with 2005. The most recent year was 412 percent of the 2003 value.

E-shipments in Computer and Electronics have grown steadily reaching a level in 2008 that was 225 percent of the level of e-shipments in 2003. The largest increase occurred in 2005.

Machine Products experienced the third largest increase over the five subsequent years. The e-shipments in 2008 were 374 percent of the 2003 level.

The overall growth of e-shipments for all of the Manufacturing industry groups was 256% in 2008 compared to 2003. Notably, four out of six industry groups out-paced the growth of e-shipments in all manufacturing groups as a whole.

The following table contains the total shipments for the six industry sub-sectors. These numbers simply serve as a reference to make comparisons between Total Manufacturing Shipments and the Total E-Shipments in the same six industry groups and the whole sector. Total shipments include both e-shipments and non-electronic commerce shipments.

Table 3: Total Manufacturing Shipments Dollar Value

Industry Group	Total Manufacturing Shipments (Millions of \$)						
	NAICS Code	2003	2004	2005	2006	2007	2008
Transp. Equip.	336	\$661,142	\$662,001	\$690,743	\$699,034	\$744,893	\$666,807
Petro & Coal	324	247,316	330,439	475,787	546,811	615,548	769,886
Chemical Prod.	324	486,563	540,883	610,873	657,082	724,081	751,030
Food Products	311	483,226	512,340	532,402	536,939	589,859	649,056
Computer & Electronics	334	352,636	365,545	372,882	390,813	403,001	391,082
Machine Prod.	333	257,375	272,123	302,650	326,583	351,531	356,954
Total Mfg ALL Shipments		4,015,081	4,308,971	4,742,076	5,015,553	5,338,307	5,486,266

Source: [34]

Table 4: Total Manufacturing Shipments Normalized

Industry Group	Total Manufacturing Shipments (Normalized Data)						
	NAICS Code	2003	2004	2005	2006	2007	2008
Transp. Equip.	336	100%	100%	104%	106%	113%	101%
Petro & Coal	324	100%	134%	192%	221%	249%	311%
Chemical Prod.	324	100%	111%	126%	135%	149%	154%
Food Products	311	100%	106%	110%	111%	122%	134%
Computer & Electronics	334	100%	104%	106%	111%	114%	111%
Machine Prod.	333	100%	106%	118%	127%	137%	139%
Total Mfg ALL Shipments		100%	107%	118%	125%	133%	137%

Source: Calculated using data from [34]

A brief comparison of the Total Manufacturing Shipments versus the Total Manufacturing e-shipments is very telling. Each of the six industry groups had growth in e-shipments that outpaced the growth of total shipments within the sector. Each of the top four industry groups for highest growth percentage (Petroleum & Coal, Food Products, Machine Products and Chemical Products) had growth over the six year period in e-shipments which was more than double the growth of all manufacturing shipments in the same time period.

Analysis and Explanation

In this section a brief discussion of example companies in each Industry Group will help to explain why the group has grown significantly in B2B e-shipments. Keep in mind that these six Industry Groups were selected because they have the highest dollar values for Total E-shipments and together these groups contribute more than 70 percent of all the Manufacturing E-shipments. We will rearrange the Industry Groups by ranking them according to the growth percentages shown in Table 2. This results in the following rank order (based on highest percentage change from 2003 to 2008):

- Petroleum & Coal
- Food Products
- Machine Products
- Chemical Products
- Computer & Electronics
- Transportation Equipment

For Petroleum & Coal, Exxon Mobil is one example company to represent this group. SAP has an e-Commerce segment focused on process industries and devoted to working with companies like Exxon Mobil and others in this industry group. In 2000, the newly merged companies, Exxon and Mobil, chose MySap.com as the e-Commerce application to integrate the B2B efforts for the combined organizations [33].

Deliveries of crude to oil refineries and delivery of gasoline to gas stations are highly repetitive and involve the same supply chain partners and the same transportation companies for the majority of the deliveries. The repetitive nature is conducive to a high degree of automated notifications through B2B e-Commerce.

Both product categories, Petroleum & Coal, also involve major shipping companies such as the Class I Railroads (e.g. CSX, Norfolk Southern, Burlington Northern Santa Fe, etc.) and ocean freight companies (e.g. Maersk, APL, etc.). These large transportation companies have implemented more sophisticated information systems in the last ten years and e-commerce is an integral part of the advancements in their information systems.

For Food Products, again there are some very large companies that lead the way for e-commerce in this group. General Mills and Kraft Foods are excellent examples for the Food Products industry group. AMR Research listed both companies for “honorable mention” for the evaluation of the AMR Top 25 Supply Chains for 2010 [17]. On the receiving end at the retail level of Food Products, two major grocery chains, Wal-Mart (#4 in 2010, #7 in 2009, #6 in 2008) and Publix (#23 in 2009, #25 in 2008) did make the AMR Top 25 multiple times [17]. We can infer that if the grocery chains have achieved excellence in their supply chains then that means the companies supplying the products are performing at a high level as well. At the retail level, point-of-sale (POS) data gathering facilitates the transfer of inventory data and allows for automatic triggering of purchase orders. These examples provide some fundamental evidence for why the Food Products sub-sector has seen significant growth in B2B e-Commerce.

Milacron, Inc. (aka Cincinnati Milacron) is one example company for the Machine Products sub-sector. Milacron initiated their e-Commerce website to provide access for smaller machine shop businesses in 1999 [24]. The website boasted more than 50,000 metalworking products and also featured interactive customer assistance for “problem-solving and technical assistance” [24]. Also in 1999, Milacron launched what was believed to be the “first full-blown e-commerce site in heavy industry” [25]. Today, customers can access information through Milacron’s website to learn more about the plastics technology for injection molding, extrusion and auxiliary equipment [26]. One segment of Milacron products is also available through an e-marketplace on the website, www.partsforindustry.com [29].

Caterpillar Inc. launched their B2B e-Commerce in 2000 with the assistance of EssentialMarkets [8]. “Caterpillar Inc. is the world’s largest manufacturer of construction and mining equipment, diesel and natural gas engines and industrial gas turbines [8]. Rated in the Fortune 100 by Fortune Magazine and ranked number 1 in its industry [8], Caterpillar is a major player in the Machine Products sub-sector. E-Commerce is particularly challenging for Caterpillar since roughly “half of its sales [are delivered] to overseas customers” [8].

Ingersoll-Rand is our third representative of the Machine Products sub-sector. Ingersoll-Rand (IR) like many others, initiated their B2B e-Commerce efforts in 2000 [9]. In fact, IR brought in a B2B entrepreneur, Rone H. Lewis, III, as the head of their e-Business sector [9]. That is an indication that IR recognized that they needed real e-Commerce expertise which likely did not exist within the company at that time. As an indication of IR’s commitment and improvement over the years, IR won the 2008 Progressive Manufacturing Award presented by *Managing Automation Magazine* [6]. That award recognized IR for “significant process improvements ... resulting from the integration of BigMachines Lean Front-End (LFE) solution to streamline complex sales quote and order processes [6].

The Chemical Products industry group shares some of the same characteristics as the Petroleum & Coal industry group. The bulk shipments and tanker carload shipments are often long term and highly repetitive to the same industrial customers. Very large companies again serve as benchmarks for how this industry does business. Dow Chemical, DuPont and PPG Industries are three examples to consider. Dow Chemical was listed alongside General Mills and Kraft for “honorable mention” for the 2010 AMR Top 25 Supply Chains [17]. Dow Chemical selected

Ariba to implement an e-Commerce solution in 1999 [30]. In fact a number of e-Commerce initiatives were undertaken in the 1999 to 2000 timeframe.

PPG established e-Commerce as a “strategic business unit” in 2000 [7]. And similar to Dow Chemical, DuPont selected Ariba for their e-Commerce initiative in preparation for the year 2000 [16]. As the Industry Group growth data indicates, it appears that those early efforts took three to five years to show substantial results. This likely means that early glitches had to be resolved and users had to be convinced to buy-in before the usage of B2B could increase.

For Computer & Electronics, there are numerous company examples to discuss. The AMR Top 25 contains six different companies from this industry group:

- Apple (#1 in 2010, 2009 and 2008)
- Cisco Systems (#3 in 2010, #5 in 2009 and #8 in 2008)
- Dell (#5 in 2010, #2 in 2009 and #3 in 2008)
- IBM (#8 in 2010, #4 in 2009 and #5 in 2008)
- Hewlett-Packard (#15 in 2010, #17 in 2009 and #18 in 2008)
- Intel (#18 in 2010, #25 in 2009 and not in Top 25 for 2008) [17].

We will discuss two of these companies in more detail.

Cisco Systems experienced a supply chain fiasco in 2000/2001 which led to the company’s first ever decline in revenues for the first quarter of 2001 [10]. From that event, Cisco took action to control their supply chain and did so through extensive use of technology. Cisco’s efforts are viewed as an outstanding example of using Internet technology to radically alter the company’s business practices. The following are some of the results that indicate Cisco’s leadership in supply chain management and their ability to leverage the Internet:

- “90 percent of orders [are] taken online.
- Monthly online sales exceed \$1 billion.
- 82 percent of support calls [are] now resolved over the Internet.
- Customer satisfaction has increased significantly” [32].

As further evidence, Cisco also won the 2008 Supply Chain Innovation Award given by the Council of Supply Chain Management Professionals (CSCMP) in cooperation with *Global Logistics & Supply Chain Strategies* magazine [1]. Cisco reduced capital investment in inventory and eliminated waste by sharing forecasts and streamlining business processes to the mutual benefit of Cisco and its partners” according to comments by Mike Burkett, AMR Research analyst [1]. Information sharing and the associated information systems appear to be a key element for this achievement and recognition.

Hewlett-Packard (HP) is another excellent example from this industry group. As described in materials from Ariba, “HP has been a member of the Ariba Supplier Network since 1999 and currently has more than 150 customer integrations globally” [2]. The benefits that HP realizes include saving “time and money on order management, including reduced order entry and processing costs. But HP believes the greatest benefit is acceleration and automation of the order-to-payment cycle” [2]. HP realizes many of these benefits because “integrated customers are the largest source of electronic orders” [2].

For Transportation Equipment, Ford, General Motors (GM) and DaimlerChrysler worked together to launch a B2B portal called Covisint in 2000 [22]. CommerceOne and Oracle, normally competitive rivals, assisted with the development and the Big Three U.S. auto companies each had a financial stake in the B2B portal [14]. The French company, Renault S.A.

and the Japanese automaker, Nissan, also joined the venture making it a global B2B exchange [14].

Compuware Corp. acquired Covisint in 2004 and the auto companies gave up their financial holdings in the company [23]. As of 2004, the auto industry had an extensive “messaging and document-delivery service” with “135,000 users in 95 countries” and those services were maintained for the auto industry by Compuware after the acquisition [23]. This example indicates the size and complexity involved in broad scale B2B especially when the reach extends to a worldwide network.

For more details about Covisint we refer to recent news on Compuware business activity: “Covisint enables companies of any size, location or technical sophistication to securely share vital business information, applications and processes across their trading partner network. ... Covisint helps businesses accelerate decision-making, reduce cost and improve responsiveness...” [31].

Another interesting fact is that Compuware Covisint was selected by the Automotive Industry Action Group (AIAG) to deliver electronic data interchange (EDI) training for automotive companies in China [31]. This decision by AIAG placed Compuware Covisint in a leading position to implement B2B e-Commerce for automotive companies in China [31].

All of this discussion points to the fact that the automotive industry is a major leader in B2B e-Commerce in total dollars of e-shipments and the duration of high levels of e-commerce. The cooperative arrangements among automakers and the backing by powerful, major players like CommerceOne and Oracle are unique factors which contributed to earlier successes when compared to other industry groups.

Discussion

The six industry groups discussed in this paper are leading the way with their usage of B2B e-Commerce. Companies within these industry groups have seen the benefits of B2B and have remained committed to making B2B work for them. One motivation may relate to “time-based performance”. Research by Iyer, Germain and Frankwick [20] provides evidence that “B2B e-commerce enhances time-based delivery performance.” Those companies with very demanding, strict time-based delivery requirements have been the ones to make significant strides with their B2B programs.

Some industries have seen industry standards or industry successes develop in e-Commerce and have benefited from the resulting standardization. Chemical Products have been led by companies such as DuPont and Dow Chemical and the solution providers such as Ariba. The Transportation Equipment industry group has been led by the big three automobile companies in the U.S. and their efforts with Covisint and ultimately Compuware [14][31].

The majority of our company examples began their B2B e-Commerce journey in 1999 or 2000. The payoff from those efforts was not immediate. There are several factors that contributed to the slow growth of B2B from 1999 through 2002. Some e-Commerce solution providers were impacted by the Dot Com meltdown around the 2000-2001 timeframe. Internal integration and internal buy-in impacted some companies in their early B2B efforts. The lack of external participation required getting buy-in from supply chain partners as well before B2B could grow to the current level that we see in recent years.

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COMPARISON OF ROBUST EMERGENCY RESPONSE FACILITY LOCATION MODELS UNDER THE RISK OF DISRUPTIONS

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ABSTRACT

In this paper, we consider the emergency response facilities location problem. After emergency events such as a natural calamity or a terrorist attack, it is critical through emergency response facilities to distribute emergency supplies to the affected areas in a timely and efficient manner for rapid recovery. The emergency response facilities considered in this paper include distribution warehouses (where emergency relief goods are stored), break of bulk points or disaster recovery centers, and neighborhood locations in need of relief goods. Based on mixed integer quadratic programming, we propose two robust models for a facility location and transportation problem for optimally locating emergency response facilities, assuming that distribution warehouses might be unavailable after disaster. We construct an Excel spreadsheet model and solve it by CPLEX for Excel Add-In. We use case studies to demonstrate the developed models' better capability to deal with the disasters.

Keywords: Emergency Response, Facility Location, Emergency Relief Goods, Spreadsheet Model

INTRODUCTION

Preliminaries

After emergency events such as a natural disaster or a terrorist attack, it is critical through emergency response facilities to distribute emergency supplies to the affected areas in a timely and efficient manner for rapid recovery. The emergency response facilities considered in this paper include distribution warehouses (DWHs), where emergency relief goods are stored, Disaster Recovery Centers (DRCs), sometimes referred to as break of bulk points (BOBs), and neighborhood locations in need of relief goods. The distribution of emergency supplies from the facilities to the affected areas must be done via a transportation network. Given the significance of transportation costs and the time involved in the distribution of relief goods, the importance of optimally locating DWHs and BOBs in the transportation network is apparent. Traditional facility location models such as set covering models, p -center models, p -median models, and fixed charge facility location problems (Daskin, 1995) implicitly assume that emergency response facilities will always be in service or be available. However, the emergency events may make response facilities become unavailable due to the collapse of bridges, building, or the facilities themselves. When that happens, the demands of the affected areas will have to be satisfied by other facilities much farther than the regularly assigned facilities. Compared to the

prior-disaster transportation costs minimized by the traditional facility location models, the actual post-disaster transportation costs can be substantially higher. Thus, it is important to minimize the post-disaster costs as well as the prior-disaster costs. In light of the significant difference between sitting emergency response facilities and other types of facilities and the paucity of the research literature in this area, we propose two innovative emergency response facility location models that can better take into account the uncertainty caused by failures of key infrastructure and would minimize the post-disaster costs. Assuming that DWHs might be unavailable after emergency events, we compare these two robust models with a non-robust model using case studies to demonstrate the developed models' capability to deal with uncertainties.

Literature Review

Facility location models have been extensively researched for decades. Dekle et al. (2005) develop a set-covering model and a two-stage modeling approach to identify the optimal DRC sites. Their objective is to minimize the total number of DRCs, subject to each county's residents being within a certain distance of a nearest DRC. Horner and Downs (2007) conduct a similar study to optimize BOB locations. In this paper, BOBs and DRCs are used interchangeably and emergency relief goods are shipped from central warehouses to BOBs and distributed to victims of catastrophic events. Given the number and locations of initial warehouses, Horner and Downs formulate the problem as a multi-objective integer programming. Two objectives are considered. The first objective is to minimize the transportation costs of servicing BOBs from warehouse locations, and the second one is to minimize the transportation costs between BOBs and neighborhoods in need of relief goods.

SIMULTANEOUS OPTIMIZATION MODEL DEVELOPMENT

Hong and Xie (2010) formulate the following integer quadratic programming (IQP) model that minimizes the sum of fixed facility costs and transportation costs from DWHs to BOBs and between BOBs and neighborhoods:

$$\begin{aligned} \text{Minimize } Z = & \beta \left[\sum_i a_i W_i + \sum_i \sum_j \left(\sum_m D_m y_{jm} \right) d_{ij} x_{ij} \right] \\ & + (1 - \beta) \left[\sum_j b_j B_j + \sum_j \sum_m D_m d_{jm} y_{jm} \right] \end{aligned} \quad (1)$$

Subject to

$$\sum_i W_i \leq N_{WH} \quad (2)$$

$$k_i \cdot W_i \leq \sum_j x_{ij} \leq K_i \cdot W_i \quad (3)$$

$$\sum_i x_{ij} = B_j \quad (4)$$

$$\sum_j B_j \leq N_{BOB} \quad (5)$$

$$\sum_j y_{jm} = 1 \quad (6)$$

$$y_{jm} \leq B_j \quad (7)$$

$$B_j \cdot LB \leq \sum_m y_{jm} \leq B_j \cdot UB \quad (8)$$

where,

- B_j – 1 if neighborhood j is selected as a BOB, 0 otherwise. (decision variable);
- W_i – 1 if candidate warehouse i is selected, 0 otherwise. (decision variable);
- x_{ij} – 1 if BOB j is covered by DWH i , 0 otherwise. (decision variable);
- y_{jm} – 1 if neighborhood m is covered by BOB j , 0 otherwise. (decision variable);
- N_{WH} – Maximum number of DWHs can be built (set to 2 in this study);
- k_i – Minimum number of BOBs a DWH must handle (set to 1 in this study);
- K_i – Maximum number of BOBs a DWH can handle (set to 5 in this study);
- N_{BOB} – Maximum number of BOBs can be built (set to 5);
- LB – Minimum number of neighborhoods a BOB needs to cover (set to 3);
- UB – Maximum number of neighborhoods a BOB can cover (set to 5);
- D_m – Demand of neighborhood m ;
- D_j – Demand of BOB j ;
- a_i – Fixed cost for constructing and operating DWH i ;
- b_j – Fixed cost for constructing and operating BOB j ;
- d_{ij} – Distance between warehouse i and BOB j ;
- d_{jm} – Distance between BOB j and neighborhood m ; and
- β – Weighting parameter $0 \leq \beta \leq 1$.

Without loss of generality, the fixed costs are considered to be the same for BOBs and for DWH in this paper. Also, the numbers of BOBs and DWHs to be built are pre-specified. For real-world applications, once the real data are available, such restrictions can be readily relaxed to generate meaningful results (see Hong and Xie (2010)). In this paper, we use the following simplified objective function for simultaneous optimization of DWHs and BOBs.

$$\begin{aligned} \text{Minimize } Z = & \beta \left[\sum_i \sum_j \left(\sum_m D_m y_{jm} \right) d_{ij} x_{ij} \right] \\ & + (1 - \beta) \left[\sum_j \sum_m D_m d_{jm} y_{jm} \right] \end{aligned} \quad (9)$$

The constraint in Equation (2) requires that at most N_{WH} DWHs can be constructed and operated; N_{WH} is provided by the user. The constraint in Equation (3) limits the minimum and maximum numbers of BOBs to be served by each DWH. The constraint in Equation (4) ensures that DWHs only supply the selected BOBs, not all candidate BOBs. The constraint in Equation (5) limits the total number of selected BOBs to be less than or equal to a user-specified number N_{BOB} . The constraint in Equation (6) makes certain that each neighborhood is assigned to exactly one BOB. The constraint in Equation (7) stipulates that neighborhoods can only be assigned to candidate BOBs that are finally selected; and constraint in Equation (8) ensures that each selected candidate BOB must cover a minimum number of LB neighborhoods and can only cover a maximum of UB neighborhoods. We call the above model given by Equations (2)-(9) as the **Integrated Facility Location** (IFL) model.

The drawback of IFL model is that the optimal plan generated by it most likely will not be optimal after disastrous events. If a DWH becomes unavailable due to the disaster, BOBs assigned to this DWH should be reassigned to other DWHs that have extra emergency relief goods in store. Then the post-disaster transportation cost may become much larger than the prior-disaster optimal cost. To reduce post-disaster transportation cost, one potential solution is to require each BOB to be assigned by multiple DWHs (two DWHs in this paper) in the IFL model. We call it the **Robust Integer Facility Location** (RIFL) model, where Equation (4) is changed

$$\sum_i x_{ij} = 2B_j. \quad (10)$$

An alternative way of developing the robust model is to add the constraints of candidate DWHs in disaster-prone area. For instance, if a DWH has a high probability of being damaged in disastrous events, one can specify that all BOBs assigned to this DWH can only have up to certain percentages of their demand satisfied by it. This strategy would avoid putting all eggs in one basket and improve the robustness of the model. In fact, if a DWH is partially damaged due to disaster, this model would be useful. Now, let x_{ij} be a continuous decision variable between 0 and 1 rather than a binary variable, denoting the fraction of BOB j 's demand satisfied by DWH i . Then, the following capacity constraint is added to the integrated facility location model:

$$0 \leq x_{ij} \leq C_i \cdot B_j, \forall j, \quad (11)$$

where C_i – *Maximum fraction of BOB's demand that can be satisfied by DWH i* ;

For candidate DWHs with a high probability of damage or shut-down during disastrous events, C_i would take relatively smaller values, whereas for DWHs in stable and safe areas, C_i would take larger values. By making x_{ij} a continuous decision variable, the robust facility location model becomes a mixed integer quadratic programming problem, which can be linearized by defining a new decision variable as follows:

$$z_{ijm} = x_{ij} \cdot y_{jm}, \quad (12)$$

where z_{ijm} denotes the fraction of neighborhood m 's demand satisfied by warehouse i via BOB j . Then solving this robust facility location problem is equivalent to solving the following mixed integer linear programming (MILP) problem:

$$\text{Minimize } Z = \beta \left[\sum_i \sum_j \sum_m D_m z_{ijm} d_{ij} \right] + (1 - \beta) \left[\sum_j \sum_m D_m d_{jm} y_{jm} \right] \quad (13)$$

Subject to

$$\sum_i W_i \leq N_{WH} \quad (14)$$

$$C_i k_i W_i \leq \sum_j x_{ij} \leq C_i K_i W_i \quad (15)$$

$$\sum_i x_{ij} = B_j \quad (16)$$

$$\sum_j B_j \leq N_{BOB} \quad (17)$$

$$\sum_j y_{jm} = 1 \quad (18)$$

$$0 \leq x_{ij} \leq C_i \cdot B_j \quad (19)$$

$$\text{Max}\{0, y_{jm} + x_{ij} - 1\} \leq z_{ijm} \leq (y_{jm} + x_{ij})/2 \quad (20)$$

$$B_j \cdot LB \leq \sum_m y_{jm} \leq B_j \cdot UB \quad (21)$$

$$y_{jm} = 0 \text{ or } 1. \quad (22)$$

We call the above model given by Equations (13)-(22) as **the Robust Continuous Facility Location (RCFL) model**. Note that if $C_i = 1, \forall i$, the RCFL model is equivalent to the IFL model and produces the exactly same solutions.

DEVELOPMENT OF A SPREADSHEET MODEL

The robust models can be solved by a variety of optimization software packages, such as LINDO, LINGO, or GAMS. However, coding the developed MILP model using these tools may not be an easy task, since so many decision variables and constraints are involved and interrelated. Recently, many researchers and practitioners pay significant attention to Microsoft Excel spreadsheet-based optimization modeling because of its non-algebraic modeling approach. Spreadsheet models lay out the relevant data, measures of performance, interrelationships, and so forth, on a spreadsheet in an organized way that facilitates fruitful analysis. Several powerful software packages based on the Excel spreadsheet model, such as Solver, What's Best, CPLEX, etc., make Excel spreadsheet-based modeling very attractive. In this paper, a CPLEX for Microsoft Excel Add-In is used to solve the proposed MILP model. This Excel Add-In provides a friendly user interface that makes coding the MILP model straightforward.

To evaluate the developed MILP model, we conduct a case study using cities in South Carolina. Fifteen cities are selected as neighborhoods and four cities are considered as candidate sites for DWH, as shown in Figure 1. Each neighborhood in Figure 1 is also a candidate location for BOB. Table 1 shows the distances between any two neighborhoods in miles, and Table 2 shows the distances between candidate BOBs and DWHs. Also shown in Figure 1 are the demands for all neighborhoods (candidate BOBs). These demands are hypothetical values proportional to each neighborhood's Year 2000 population and can be readily replaced by true demand data for real-world applications. Based on these input data, an Excel Spreadsheet model is developed and available upon request from the authors.

CASE STUDY AND OBSERVATIONS

Using CPLEX, we solve three facility location models, IFL, RIFL, and RCFL, based on the data. To show how robust the RIFL and RCFL models are, two scenarios are considered. The first (normal) scenario assumes all candidate DWHs remain available after disastrous events, while the second one considers the shutdown/unavailability of a DWH. Hereinafter, the first and second scenarios are referred to as normal and shutdown scenarios.

Suppose that DWH Lexington, which turns out to serve more BOBs than the other DWH, would be unavailable for the shutdown scenario. With setting weighting factor, β , equal to 0.5, the results of facility location and transportation scheme for the normal as well as shutdown scenarios generated by the three models are presented in Table 3. Note that DWH Lexington is unavailable for the shutdown case for each model. Consequently, the total weighted cost (TWC) in Equation (12) for each model increase. The amounts of the increase in TWC are also reported in Table 3. We can observe that the RCFL model seems to be the most robust. That is, RCFL generates a slightly higher TWC for the normal scenario, but produces a lower TWC for the shutdown case than IFL, whereas, regardless of scenario, RIFL generates the highest TWCs among three models. Note that the three models select the same optimal DWHs, but the optimal solutions for BOBs covered by the DWHs are different.

To better compare three models, we evaluate and compare their performance for different values of β and report the resulting TWCs in Table 5. For $\beta = 0.7$, we report the results of facility location and transportation scheme in Table 4 as we do in Table 3. From Tables 3 and 4, we see that the optimal DWHs selected by non-robust IFL are different from the ones by the robust RIFL and RCFL models and that the weighting factor β significantly affects the results. We can observe that the two robust models, RIFL and RCFL, outperform than the non-robust IFL model under the shutdown scenario, though they slightly underperform for the normal scenario.

A ratio of savings (RS) is calculated using equation (23) to show the advantages of the robust model over the integrated model.

$$RS = \frac{SV(S)}{|SV(N)|} \quad (23)$$

Figure 1. Candidate Warehouses, BOBs, and Neighborhoods

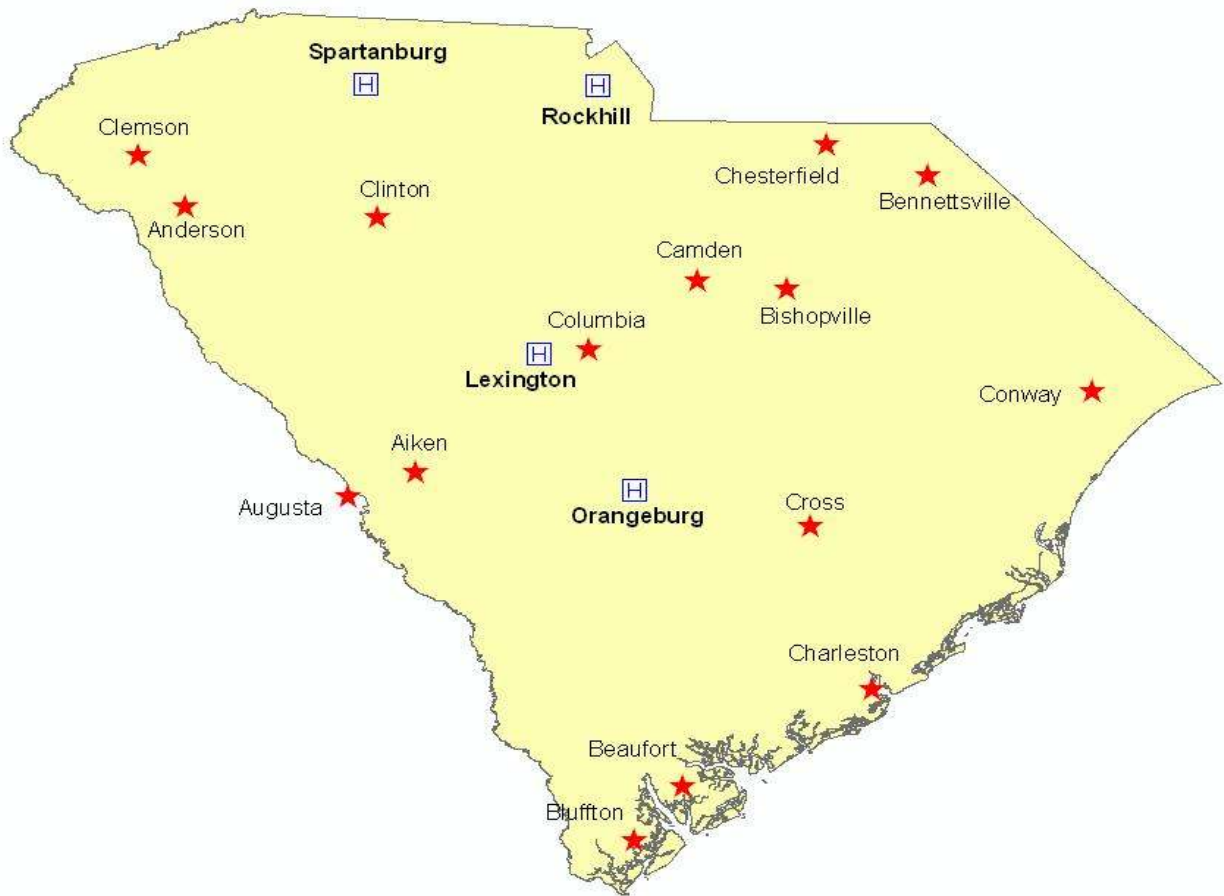


Table 1. Distances between Neighborhoods

Neighborhood (M)	Aiken	Anderson	Augusta	Bishopville	Beaufort	Bennettville	Bluffton	Camden	Charleston	Chesterfield	Clemson	Clinton	Columbia	Conway	Cross	Demand
Aiken	0.00	99.69	16.98	104.59	121.37	155.39	157.41	86.19	162.96	135.14	120.42	106.67	56.41	186.02	141.94	25
Anderson	99.69	0.00	92.34	166.63	246.70	212.18	266.39	148.32	226.73	195.06	18.05	57.81	116.50	253.07	201.75	25
Augusta	16.98	92.34	0.00	147.18	127.63	197.73	147.33	128.68	207.56	167.52	110.82	128.28	75.10	228.30	157.25	190
Bishopville	104.59	166.63	147.18	0.00	173.08	44.90	192.72	22.97	153.77	44.44	187.67	110.89	53.21	83.21	111.27	4
Beaufort	121.37	246.70	127.63	173.08	0.00	191.48	29.34	166.79	70.32	200.88	271.49	191.54	134.16	188.83	103.40	13
Bennettville	155.39	212.18	197.73	44.90	191.48	0.00	211.12	73.77	172.17	27.86	238.47	161.69	104.01	72.34	129.66	9
Bluffton	157.41	266.39	147.33	192.72	29.34	211.12	0.00	180.38	92.94	212.68	282.47	206.45	146.86	202.02	116.58	2
Camden	86.19	148.32	128.68	22.97	166.79	73.77	180.38	0.00	146.74	48.96	169.48	93.04	34.69	110.14	125.72	7
Charleston	162.96	226.73	207.56	153.77	70.32	172.17	92.94	146.74	0.00	179.93	248.36	173.38	114.54	97.41	45.53	97
Chesterfield	135.14	195.06	167.52	44.44	200.88	27.86	212.68	48.96	0.00	0.00	204.68	117.75	83.64	100.30	146.12	2
Clemson	120.42	18.05	110.82	187.67	271.49	238.47	282.47	169.48	248.36	204.68	0.00	69.53	128.22	264.79	213.47	12
Clinton	106.67	57.81	128.28	110.89	191.54	161.69	206.45	93.04	173.38	117.75	69.53	0.00	62.42	198.20	151.10	8
Columbia	56.41	116.50	75.10	53.21	134.16	104.01	146.86	34.69	114.54	83.64	128.22	62.42	0.00	140.20	88.17	116
Conway	186.02	253.07	228.30	83.21	188.83	72.34	202.02	110.14	97.41	100.30	264.79	198.20	140.20	0.00	100.21	12
Cross	141.94	201.75	157.25	111.27	103.40	129.66	116.58	125.72	45.53	146.12	213.47	151.10	88.17	100.21	0.00	1

Table 2. Distances between Candidate BOBs and Warehouses

DWHs	Aiken	Anderson	Augusta	Bishopville	Beaufort	Bennettville	Bluffton	Camden	Charleston	Chesterfield	Clemson	Clinton	Columbia	Conway	Cross
Lexington	42.81	121.42	62.69	64.00	138.50	109.68	158.14	45.49	118.88	94.44	143.25	66.47	15.11	150.56	93.74
Orangeburg	71.59	155.80	91.06	93.47	98.43	129.46	116.01	75.07	78.46	124.01	176.25	101.85	42.43	127.08	57.43
Rockhill	120.86	120.92	141.52	104.64	207.58	93.99	225.13	70.18	184.42	65.32	129.44	65.93	68.56	192.87	163.40
Spartanburg	140.57	63.10	126.48	143.95	228.33	170.35	244.79	125.54	205.18	142.49	68.50	37.39	95.48	231.79	180.48

Table 3. Results Comparison for Normal/Shutdown Scenarios for Three Models ($\beta=0.5$)

$\beta=0.5$	Scenario							Increase (b)-(a)
	Normal			Shutdown			TWC (CDB, CBN) (b)	
	DWH Locations Selected	BOBs Covered by DWH	TWC (CDB, CBN) (a)	DWH Locations Selected	BOBs Covered by DWH	TWC (CDB, CBN) (b)		
IFL	Lexington (412)	Aiken (217) Bishopville (25) Clinton (45) Columbia (125)	16535.89 (24478.73, 8593.05)	Orangeburg (523)	Aiken (216) Bishopville (25) Clinton (45) Columbia (125) Charleston (112)	22517.62 (36474.71, 8560.52)	5981.73	
	Orangeburg (111)	Charleston (111)						
	Lexington (513)	Aiken (217) Bishopville (25) Clinton (45) Columbia (226)	19173.92 (18046.48, 20301.35)	Orangeburg (523)	Aiken (217) Bishopville (25) Camden(10) Clinton (45) Columbia (226)	26548.13 (32794.91, 20301.35)		7374.21
Orangeburg (10)	Camden (10)							
Lexington (396)	Aiken (219) Clinton (45) Columbia (132)	16719.48 (24645.00, 8793.95)	Orangeburg(523)	Aiken (219) Clinton (45) Columbia (132) Beaufort (16) Charleston (111)	22470.05 (36146.16, 8793.95)	5750.57		
Orangeburg (127)	Beaufort (16) Charleston (111)							

CDB: Cost from DWHs to BOBs, 1st Term in Eq. (12). **CBN:** Cost from BOBs to Neighbors, 2nd Term in Eq. (12). **TWC=** β *CDB + (1- β)*CBN
 (): Demand in 1000s

Table 4. Results Comparison for Normal/Shutdown Scenario for Three Models ($\beta=0.7$)

$\beta=0.7$	Scenario							Increase (b)-(a)
	Normal			Shutdown (DWH Lexington)				
Model	DWH Locations Selected	BOBs Covered by DWH	TWC (CDB, CBN) (a)	DWH Locations Selected	BOBs Covered by DWH	TWC (CDB, CBN) (b)		
IFL	Lexington (478)	Aiken (40) Bishopville (25) Camden (28) Columbia (403)	17365.41 (11206.00, 31737.38)	Spartanburg (523)	Aiken (15) Bishopville (15) Camden (27) Columbia (63) Clinton (403)	37806.37 (28740.79, 58959.39)		20440 96
	Spartanburg (45)	Clinton (45)						
RIFL	Lexington (513)	Aiken (62) Bishopville (15) Camden (27) Columbia (403)	18331.37 (11850.66, 33453.01)	Orangeburg (523)	Aiken (39) Bishopville (7) Camden(24) Columbia (331) Cross (122)	26663.01 (26298.77, 27512.89)		8331 64
	Orangeburg (10)	Cross (16)						
RCFL	Lexington (508)	Aiken (219) Camden (20) Clinton (22) Columbia (403)	18227.20 (12019.95, 32170.79)	Orangeburg(523)	Aiken (39) Camden (20) Clinton (11) Columbia (331) Cross (122)	22470.05 (36146.16, 8793.95)		4242.85
	Orangeburg (15)	Cross (15)						

CDB: Cost from DWHs to BOBs, 1st Term in Eq. (12). **CBN:** Cost from BOBs to Neighbors, 2nd Term in Eq. (12). **TWC**= β *CDB + (1- β)*CBN

(): Demand in 1000s

Table 5. Comparison between Integrated and Robust Models with Different β Values

Weighting Factor, β	Scenario	TWC			SV(N) (a)-(c)	RS (=SV(S)/SV(N))
		IFL (a)	RIFL (b)	RCFL (c)	SV(S) (a)-(c)	
0.1	Normal	6560.58	6585.49	6560.58	0	—
	Shutdown	7677.89	7748.29	7677.89	0	
0.2	Normal	9433.58	9589.62	9455.91	-22.33	3.07
	Shutdown	11759.01	11960.48	11690.35	68.66	
0.3	Normal	12271.30	13346.68	12351.23	-79.93	1.02
	Shutdown	15782.91	16934.78	15701.42	81.49	
0.4	Normal	14804.07	15125.22	14804.07	0	—
	Shutdown	19551.02	19845.37	19551.02	0	
0.5	Normal	16535.89	19173.92	16719.48	-183.59	0.25
	Shutdown	22517.62	26548.13	22470.05	47.57	
0.6	Normal	17917.77	18918.61	18090.30	-172.53	73.98
	Shutdown	37572.28	27702.79	24807.51	12764.77	
0.7	Normal	17365.41	18331.27	18227.20	-861.79	17.79
	Shutdown	37806.37	26663.01	22470.05	15336.32	
0.8	Normal	15312.28	16171.13	16376.06	-1063.78	7.79
	Shutdown	34784.51	26541.59	26490.85	8293.66	
0.9	Normal	13259.14	14010.89	14134.57	-875.43	6.32
	Shutdown	31758.61	26290.97	26223.99	5534.62	

$SV(S)$: Savings for the shutdown case. $SV(N)$: Savings for the normal case.

where $SV(S)$ denotes the savings for the shutdown case and $SV(N)$ the savings for the normal case. Note that when β is greater than 0.5, both the robust RIFL and RCFL models outperform the IFL model and that the TWC of RCFL model is always the lowest regardless of the value of β in shutdown scenario. We see that as β becomes close to one or less than 0.5, the advantage of RCFL becomes insignificant. Thus, it is recommended that the proposed RCFL model be used for optimally locating DWHs under the risk of disruptions. As discussed previously, transport of relief goods happens mostly after disaster. Therefore, for sitting emergency response facilities, it is more important to minimize the post-disaster cost rather than the prior-disaster cost and to better consider the unavailability of emergency facilities. The example provided here clearly demonstrates that the proposed robust facility location models can well suit the needs of sitting emergency response facilities.

SUMMARY AND CONCLUSIONS

In this paper, we develop two robust transportation and facility location models and compare them with a non-robust IFL (Integrated Facility Location) model. For the RCFL (Robust Continuous Facility Location) model, we introduce a continuous variable, defined in Equation

(10), to denote capacity constraint on a candidate DWH in disaster-prone areas, so that it can only partially satisfy the demand of BOBs. We formulate the problem as a mixed integer linear programming model and solve it using CPLEX for Microsoft Excel Add-In. For the RIFL (Robust Integer Facility Location) model, we set the constraint requiring each BOB to be served by multiple DWHs (two DWHs in this paper) on the IFL model, which requires each BOB to be served by one DWH. Using numerical examples, it is shown that the RCFL model yields facility location plans of slightly higher TWCs than the IFL or RIFL model under normal situations. However, the RCFL model generates more robust facility location plans than the other two models in the sense that it can perform better when some of the selected DWHs are shut down after disaster. The main purpose of establishing emergency response facilities is for distributing relief goods after disaster. Therefore, when evaluating the efficiency and robustness of emergency response facility location plans, more weights should be given to their post-disaster performance. The resulting RCFL model is designed in a robust manner such that it can better address scenarios with failures of key transportation infrastructure. Case studies are conducted to demonstrate the developed model's capability to deal with uncertainties in transportation networks. Thus, the developed RCFL model can help federal and local emergency response officials develop efficient and robust disaster relief plans.

The paper assumes that, after disaster, only DWHs can be unavailable, not BOBs. In fact, selected BOBs can also be unavailable after such an emergency event (See Hong and Xie (2010)). For future research, it would be necessary to develop a robust as well as an integrated transportation and facility location models when both a DWH and a BOB can be unavailable in the shutdown scenario. In addition, we implicitly assume that each DWH always carries enough inventories of emergency relief goods, so that, for the shutdown scenario, the other DWH(s) can ship enough relief goods to the extra BOBs. Thus, it would be also interesting to include the constraint on the capacity of DWHs in our proposed models.

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ENSURING SERVICE SAFETY

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ABSTRACT

This paper identifies service safety as separate dimension of quality and considers the need to view safety from the frontline worker's perspective. Stewart's [12] "3 T" framework is used to categorize safety training by task, treatment and tangibles. Results from a survey of public transit bus drivers are presented. Results show that the questions categorized as treatment and tangibles were significant predictors of perceived safety.

INTRODUCTION

No one wants to patronize a service that may pose safety risks to its customers. All frontline service employees understand this notion intuitively and many realize that they play a major role in ensuring a safe service environment. Frontline employees also know, perhaps better than anyone in the service organization, how well the service is achieving its safety goals. Their first hand experience with customer safety offers insights that external audits and managerial oversight cannot provide.

The service management literature has long emphasized the importance of the frontline employee in maintaining service quality [3] [13] [1] [2]. However, past research has seldom considered safety as a separate dimension of service quality; instead, other components such as timeliness, completeness, courtesy, consistency, accessibility, accuracy and responsiveness are commonly delineated as key service quality dimensions [6]. In contrast, safety has always been a key dimension of product quality [7]. This study will follow the approach to safety taken in the manufacturing literature and identify service safety as a separate dimension of quality. Such an approach intensifies the need to view safety from the frontline worker's perspective. This study will describe a survey methodology designed to gain this frontline perspective and will report the results of its implementation in an actual service context.

This paper is organized as follows. The following section will present a framework for classifying various components of customer safety in a service setting. A discussion of the research context and methodology follows the framework description. Next, the results from the survey implementation are given. The paper concludes with the managerial implications of the study and suggestions for further research.

SERVICE SAFETY FRAMEWORK

Like service quality, service safety involves a wide array of individual service attributes. The size of the attributes set will vary with the particular service context. Even though the size of the attribute set may vary, a systems based framework can help the manager organize the attributes by major system component type. A number of such frameworks have been described in the service quality literature (See, for instance: [12], [2], [11], and [9]. The number of components in these frameworks is limited; usually only three components comprise the framework. As Stewart [12, p.248] has observed, the framework components “provide a perspective that is closely aligned to the actual decision making and manipulation of the operations manager.” Stewart’s rationale for collapsing multiple attributes into a small set of major service components applies to service safety. Consequently, this paper will adopt the systems framework proposed by Stewart [12] and use it to classify a range of service elements related to safety.

Stewart’s [12] framework consists of three major components. These are: 1) task, 2) treatment and 3) tangibles. In the service literature, these three components are collectively known as the “3 T’s.”

According to Stewart [12, p.448], the task component can be defined as “what must be done.” Task obviously includes the core service activity. For example, in a public bus system, the core task is transit. In the restaurant industry, the core task is food preparation. In addition to the core task, the task component encompasses processes, procedures and algorithms. In describing the task component of the “3 T’s” model, Stewart [12, p. 249], delineates the following characteristics of a task: 1) it is “temporal in nature” because every task has a specific start time and a specific finish time, 2) a task may be planned in advance but more often depends on the resolution of the actual service encounter for its completion, 3) task evaluation can include both time-based measures and more subjective elements.

In contrast to the task component, the treatment component deals primarily with the “emotional/social context of the encounter” [12, p.248]. Thus, the treatment component encompasses interactions that occur between the service worker and the customer. The role of frontline service workers in these interactions can not be under-estimated since “service employees represent the organization in the customers’ eyes and in many instances they are the service” [5, p. 167]. For example, a rude waiter can spoil an otherwise pleasant dining experience for a customer and leave that customer with a negative impression of the particular restaurant. On the other hand, an empathetic flight attendant can re-assure an anxious airplane passenger and thus help the passenger enjoy flying on that particular airline.

Finally, the tangibles component differs from the preceding two components in that it refers to the “facilities and the facilitating goods of the service” [12, p. 248]. Stewart [12] underscores the following characteristics of the tangibles component: 1) it is relatively easy to measure performance in the tangibles category and evaluation criteria are typically objective and easy to understand, 2) managing tangibles must address such issues as functionality, maintenance and repair and 3) much of the work in managing tangibles can be performed without any customer involvement. For instance, in a public transit system vehicle maintenance is routinely scheduled, performance is easily measured by metrics like fuel mileage, tire wear and brake lining wear and maintenance activities occur in a work area that is not accessible to riders.

While the “3 T’s” help the service manager to integrate a variety of service attributes into a single framework, they can not by themselves render a complete view of service safety at an individual service operation. However, when used in conjunction with the first hand knowledge that frontline workers possess, the “3 T” framework can help the service manager determine which service elements to emphasize to promote service safety. The following section describes such an application of the “3 T’s” framework in an actual service setting.

METHODOLOGY AND CONTEXT

Context

The research context for this study was an urban transit system located in western North Carolina. The system was not among the 50 largest systems in the United States; it was a smaller motorcoach-based system. The system has been in operation for over 19 years and logged over three million passenger trips in 2009. The buses operate seven days a week and cover 15 routes. While the transit system provides service on regular city routes, furnishes paratransit services and operates a university-based system, the bus drivers for the regular city routes were the only front line workers who participated in this study.

Methodology Application

Working in conjunction with the transit director and the director of safety, the authors devised a survey to assess bus drivers’ perceptions of service safety at this transit operation. Table 1 lists the nine safety-related attributes that were used as survey items. In completing these questions, the drivers had to assess the degree to which the system has emphasized each item during training. All nine questions were measured on a Likert-scale ranging from one which was defined as no emphasis in training, to five which was defined as much emphasis in training. Training encompassed not only the formal training sessions all new drivers must attend but also safety assurance programs, workshops and monthly drivers’ meetings.

As Table 1 shows, the survey contained a tenth item which asked the drivers to rate the overall level of safety at this transit system. To answer this question, the drivers reflected on their entire experience at this system, not solely on their training experience. Question 10 used a Likert scale which ranged from 1, which designated very low levels of driver perceived safety, to 5, which corresponded to very high levels. The bus driver surveys were completed at a regular monthly drivers’ meeting and were administered by the safety director. All surveys were anonymous. A total of 87 surveys were collected at the end of the meeting. A total of 73 were complete.

TABLE 1¹
MEANS, STANDARD DEVIATIONS AND CORRELATIONS

Question	Mean	Standard Deviation	Correlations									
			1	2	3	4	5	6	7	8	9	10
1. Emphasis on Policies and Procedures	3.96	1.123	–	.506	.548	.677	.410	.640	.554	.529	.452	.529
2. Emphasis on Equipment Operation	4.05	1.079		–	.443	.622	.357	.468	.472	.476	.421	.620
3. Emphasis on Security	3.82	1.183			–	.463	.460	.464	.532	.394	.565	.425
4. Emphasis on Safety	4.36	1.005				–		.682	.573	.648	.455	.545
5. Emphasis on Rider Relations	3.90	1.169					–	.609	.694	.593	.508	.445
6. Emphasis on Incident Recognition	4.10	1.145						–	.627	.632	.473	.497
7. Emphasis on Incident Handling	4.25	0.954							–	.836	.524	.525
8. Emphasis on Incident Reporting	4.19	1.089								–	.359	.378
9. Emphasis on Practice Driving with Experienced Driver	3.99	1.286									–	.474
10. How Would You Rate the Level of Safety?	3.97	.957										–

¹ n = 73 and all correlations significant at $p \leq .001$

The descriptive statistics that resulted from the preliminary data analysis of the survey data are shown in Table 1. These results reveal that the drivers perceived the greatest system emphasis on passenger safety (mean = 4.36) and incident handling (mean = 4.25). In contrast, Table 1 reveals that drivers perceived the least emphasis on security (mean = 3.82) and rider relations (mean = 3.90).

Table 2 presents the next stage in the preliminary analysis in which the “3 T’s” framework was used to collapse the first 9 survey items into three broad categories. As Table 2 shows, items dealing with policies and procedures, incident reporting and practice driving were put in the task category. Collectively, these items reflect the core task (driving) and also processes (policies and procedures and incident reporting). The treatment category contains items relating to security, passenger safety, rider relations, incident recognition and incident handling. These items deal with interactions occurring between the driver and the bus passengers. The final category, tangibles, contained only the item corresponding to equipment operation. This category reflects such issues as functionality and maintenance, which are two important considerations in safe equipment operation. The descriptive statistics for the “3 T’s” shown in Table 3 reveal that the means for all three categories were similar (task mean= 4.0456, treatment mean= 4.0849 and tangibles mean = 4.0548). Table 3 also shows that treatment and task were positively correlated.

**TABLE 2
STEWART’S “3T” FRAMEWORK**

Framework Category	Survey Question
Task	1. Emphasis on Policies and Procedures 8. Emphasis on Incident Reporting 9. Emphasis on Practice Driving with Experienced Driver
Treatment	3. Emphasis on Security 4. Emphasis on Safety 5. Emphasis on Rider Relations 6. Emphasis on Incident Recognition 7. Emphasis on Incident Handling
Tangibles	2. Emphasis on Equipment Operation

TABLE 3¹
MEANS, STANDARD DEVIATIONS AND CORRELATIONS FOR STEWART’S “3T”
FRAMEWORK

Category	Mean	Standard Deviation	Task	Treatment	Tangibles
Task	4.0456	0.92524	–	.878	.587
Treatment	4.0849	0.87173		–	.586
Tangibles	4.0548	1.07871			–

¹ n = 73 and all correlations significant at p ≤ .000

Since the “3 T’s” framework can help guide decision making in a service operation, it is useful to consider how the task, treatment and tangibles categories delineated in Table 3 affect the bus drivers’ perceived transit safety at this transit operation. To examine this question, the authors used regression analysis to model the relationship between perceived safety and the “3 T’s.” The results of this analysis are given in the next section. In addition, the results of a second model in which perceived safety is modeled as a function of the 9 individual safety items are also presented.

RESULTS

In the initial regression model, the dependent variable, the perceived level of safety (Question 10), was regressed against the average scores for task, treatment and tangibles. Stepwise regression resulted in a model which included tangibles and treatment as independent variables but omitted task (see Table 4). The model had an adjusted R² of 45.9% and was significant at p-value <.0001. Individual t-tests showed that both variables were significant in the final model (tangibles had a p-value of <.0001 and treatment had a p-value of .001). The variance inflation factor was 1.522, well below the accepted limit of 10 [8], [4], [10] (See Table 5). The regression equation may be stated

$$Y = .963 + .359 X_{Tangibles} + .405 X_{Treatment}$$

TABLE 4¹
REGRESSION RESULTS FOR STEWART’S “3T” CATEGORIES
DEPENDENT VARIABLE: HOW WOULD YOU RATE THE LEVEL OF SAFETY?

Predictor	Beta	P-Value for T Test
Treatment	.405	.001
Tangibles	.359	.000

¹ n = 73; Adjusted R² = 45.9%; Model Significant at p ≤ .000

TABLE 5¹
MULTICOLLINEARITY MEASURES FOR STEWART'S "3T" MODEL

Variable	Tolerance	Variance Inflation Factor
Treatment	.657	1.522
Tangibles	.657	1.522

¹ n = 73

In the second model, the dependent variable, level of safety, was regressed against the nine attributes (found in items 1-9) using Stepwise regression. The analysis identified a four-variable model consisting of: X_2 (training emphasis on equipment operation), X_7 (emphasis on incident handling), X_8 (emphasis on incident reporting) and X_4 (training emphasis on passenger safety) (see Table 6). The model had an adjusted R^2 of 49.1% and was significant (p-value <.001). Individual t-tests showed that all the variables were significant in the model (p-values ranged from .000 to .038). Multicollinearity was not considered a problem because the variance inflation factors ranged from a low of 1.687 to a high of 3.870 [8], [4], [10] (Table 7). The resulting regression equation may be stated as

$$Y = .689 + .362 X_2 + .565 X_7 - .403 X_8 + .252 X_4$$

TABLE 6¹
INITIAL REGRESSION RESULTS
DEPENDENT VARIABLE: HOW WOULD YOU RATE THE LEVEL OF SAFETY?

Predictor	Beta	P-Value for T Test
2. Training emphasis on equipment operation	.362	.000
7. Training emphasis on incident handling	.565	.001
8. Training emphasis on incident reporting	-.403	.007
4. Training emphasis on safety	.252	.038

¹ n = 73; Adjusted $R^2 = 49.1\%$; Model Significant at $p \leq .001$

TABLE 7¹
MULTICOLLINEARITY MEASURES FOR INITIAL REGRESSION

Variable	Tolerance	Variance Inflation Factor
2. Training emphasis on equipment operation	.593	1.687
7. Training emphasis on incident handling	.293	3.408
8. Training emphasis on incident reporting	.258	3.870
4. Training emphasis on safety	.453	2.207

¹ n = 73

DISCUSSION

The regression results presented in the preceding section yielded several managerial implications for the transit system in this study. These deal with the relative importance of task, treatment and tangibles, the apparent lack of significance of certain survey items and the role of worker training in service safety.

The results of the first regression analysis revealed that the task category was not a significant predictor of perceived safety. This result is not surprising given the three items that comprise this category: 1) policies and procedures, 2) incident reporting and 3) practice driving. Emphasis placed on these items during training does not translate into higher perceived safety. For instance, practice driving with an experienced driver is less relevant for an experienced bus driver who most likely increases his driving skill every day just by doing his job. In the second regression model, the negative beta coefficient for emphasis on the incident reporting variable indicates an inverse relationship between incident reporting and perceived passenger safety. In this case, drivers equate more emphasis on reporting with “more red tape” and less time available for the really important safety issues.

In contrast to the task category, the treatment and tangibles categories were significant variables in the first regression. Emphasis on two key items in this category – handling an incident and passenger safety – underscores the interactive nature of the driver’s role in safety assurance. Drivers must be alert to passenger behavior to prevent mishaps or incidents from occurring and must react in an effective yet reassuring manner when incidents do occur.

Emphasis on equipment operation (tangibles) also affected drivers’ perceptions of safety in this study. This result is also not surprising. Reliable equipment operation requires that the driver inspect his vehicle prior to beginning his route and to make sure that routine maintenance occurs. Experienced drivers realize that such behaviors are worth emphasizing in training since they are an integral part of everyday operations.

In contrast with individual items such as equipment operation and incident handling, security was not a significant variable in the second regression. This result is rather surprising since security by definition involves denying public access to work areas or equipment in order to

prevent possible incidents and accidents. Perhaps the drivers surveyed perceived security as more of a managerial issue than a front line worker issue.

This paper focused on the role of front line service workers in assuring service safety. However, just as in the broader case of service quality, the service customer can also play a more active role. This would require increased customer awareness of safety issues. In this sense, helping the customer to do a better job in his or her role as customer could help to improve service safety. Thus, the failsafing mechanisms described by Chase and Stewart [3] could help the customer more safely navigate the service environment. The effectiveness of such mechanisms used in combination with frontline worker perspectives would provide an interesting avenue for future research.

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Sustainable Operations -- Factor of Production, Corporate Responsibility or Competitive Advantage?

Sustainability is arguably the biggest “movement” in corporate America since the quality and lean movements of the past 20 to 30 years. More and more mainstream companies are taking steps to integrate sustainability into their operations and corporate strategies. At the same time, our universities are integrating sustainability into a myriad of courses, curriculums and majors. For business students, and operations majors in particular, the study of sustainability lends itself to a three-prong investigation of intent, resolve and results.

We have assembled a panel of academicians who teach operations and supply chain management courses to discuss the evolution of sustainability from factor of production, to corporate responsibility, to competitive advantage. Using this structure to scaffold the introduction and study of sustainability will help to ensure that in the future *sustainability* will be as fundamental as profitability or innovation in the lexicon of business strategy and operations.

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UNTANGLING THE MYSTERIES OF TEACHING WITH SYNCHRONOUS TOOLS

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ABSTRACT

With an interactive and personalized platform for real-time presentation, communication, and collaboration, synchronous desktop web-conferencing tools, such as Elluminate Live!, are intended to enable convenience and simulated classroom experience for teaching and learning in online environments [1]. To make the best use of the functionalities provided in these tools and find the fit of these features in teaching blended and online courses, educators need to investigate aspects in the design, development, and implementation of synchronous online learning activities.

INTRODUCTION

Online teaching and learning are facilitating more and more education opportunities, and at the same time, challenging higher education with innovative modalities and constant updates of technologies [2]. Enabling remote, flexible, and self-directed learning opportunities, asynchronous communication and learning management systems have been long and widely used. Recently, the exponential growth of Internet, various web-based media, easy access to computing software and hardware, and the desire to simulate physical classroom activities catalyzed the adoption of real-time interaction with synchronous tools. Compared with their asynchronous counterpart, synchronous tools facilitate real-time interaction, presentation, and communication without requiring participants' presence at the same physical location. Voice over IP, video capabilities, file transferring, shared online presentation space, collaborative capabilities, and archiving features, allow a plethora of options for users to choose from and use in teaching and learning activities. Given the abundant features, Anderson, etc. [3] proposed best practice in facilitating synchronous sessions in online distance courses.

The unique pattern of synchronous interaction that matches an instructor's teaching style includes identification of a problem to be solved with real-time online interactivity, analysis of the problem, planned solution to the problem, activity structure, and support structure to ensure student participation. In addition, as the blends of face-to-face and online instruction are identified as more effective than either face-to-face classroom-based only or fully distance learning [2], synchronous tools start their presence in blended learning, and are used more and more as providing an extended teaching and learning environment than merely virtual meeting space [1]. The novice, fast development, and expanded application of these synchronous tools, however, resulted in the documentation of their use being limited within the abilities of facilitation. To explore their pedagogical potential, evidences in real-world teaching practices and perspectives need to be collected and analyzed [4].

Many questions need to be explored further:

- How does an instructor form an interactive pattern for the unique use of Elluminate Live! in teaching?
- How does the design of an entire course affect the use of synchronous sessions?
- What are some critical logistical issues to plan ahead of time?
- What are the potential of using Elluminate Live! for online testing?
- How can some of the limitations be eliminated in future practice?

ELLUMINATE LIVE!

When it comes to best practices using a tool like Elluminate Live!, the most important things to consider are your students and yourself. Just like teaching in a traditional classroom environment, there are things that you do and don't do in order to make your face-to-face classes excellent learning experiences. Most likely there are options in Elluminate Live! that enable the same experience. It seems that a student stating that a synchronous Elluminate Live! session was "just like being in class" is an excellent compliment. With functionalities such as interactive White Board, text and audio chatting options, question polling, student raising hand, group breakout rooms, web navigation, application sharing, file sharing, and Quiz Manager, the "just like being in class" experience can be created with purposeful design and implementation, such as:

1. Show and demonstrate the basic capabilities to the students that you plan to use in Elluminate Live! during the first session. Students need to understand that the tool is just as friendly (or almost as) friendly and as being there with you face-to-face.
2. Be sure you have a very clear introduction in your session (especially early in the term) stating when the session will begin and reminds everyone of the most frequently used terminologies. Students may get confused without specific and detailed instruction.
3. Make sure that the session is interactive with an understanding that you will be busy during the session and do not permit anything that hinders the learning experience to occur (just like in class). If the students stay on topic with their Elluminate chat, the discussion can continue as long as they want, which would not be possible in a physical classroom.
4. Make decisions on to use or not use, such as the application of webcam, audio or text chat, through constant communication with students throughout the session, starting as early as possible.
5. Make sure that the students appreciate that this is a "normal" day of class and should not be missed.

Elluminate Live! provides functionality that allows an instructor to provide online office hours that can be described as "just like in the office". A few of the same capabilities mentioned above such as interactive White Board and text and audio chatting options contribute to online office hours more often than the other tools. In addition, the ability to video conference and "share an application" from the students desktop to the faculty's or vice versa enhance the online hours experience. For instance, an instructor can demonstrate the structure of a course site or online review materials by guiding students with Elluminate web navigation and application share features.

In addition to the pedagogical and structural strategies, Elluminate sessions can be recorded and archived for later use. The recorded sessions allow students who missed the original session the opportunity to watch and learn, and allow all students the opportunity to review any session that they wish. Imagine a student studying for a test the night before and trying to remember a given concept... Using recordings students can revisit that portion of the Elluminate Live! session and be better prepared for the test.

Academic integrity has always been a concern about assessment in teaching online. It is recommended that multiple layers and approaches of assessment be used to measure student learning performance [5]. Just as in a face-to-face classroom, testing environment is recommended to be strategically designed and set up to reduce cheating temptations [6]. Elluminate can be used as an alternative way for remote test taking and can emulate both students and faculty in the same location. With a careful design, Elluminate can be used to create a virtually proctored assessment environment and alleviate the unique challenge of online testing.

PRACTICE

Thus far, Elluminate Live! (or a similar synchronous tool) has been used at the authors' school to reach approximately 700 undergraduate students in twelve hybrid and eleven online classes that are taught by the Computer Information Systems (CIS) department in the College of Business. The two classes taught thus far include Computer Information Systems and Principles of Programming. The Computer Information Systems class is an introductory course that describes Management Information Systems and is required of all business majors (and some minors). Mostly freshmen attend that class. The Principles of Programming class is an introductory programming course that uses Visual Basic. The Programming class is required of all CIS majors or minors.

Both classes have used the presentation and archiving capabilities of Elluminate Live!. The programming class requires one-on-one programming assistance so online office hours are much more frequent to help students understand concepts and debug their software. In addition, the programming tests have used Elluminate Live ! for a common final exam when the class has been taught online over the summer.

ISSUES

Many undergraduate students do not like to speak using Elluminate Live! audio chat feature. The presenters will discuss how they use different options to engage students in synchronous learning activities. One of the challenges of teaching an online synchronous class is whether a professor needs to prepare and deliver an Elluminate Live! session differently from face-to-face delivery of the same material, without the physical ambience in a classroom. A webcam can allow an instructor to see a few of the students at one time, what if an Elluminate Live! session includes 50 students? Even though Elluminate has the recording options, how does an instructor motivate students to participate in a live session and have the real-time learning experience? What are the attendees' thoughts on the synchronous teaching tools? The presenters will discuss these with the audience as well.

CONCLUSION

After semesters of teaching with synchronous sessions, the presenters found that the students' feedback provided the following criteria to evaluate their online or blended classes:

- Students should complete a course equally successfully whether it was taught fully online or hybrid or face-to-face. The students overall GPA could be a good measure of the comparable success.
- Students should achieve the same level of proficiency in an online or blended class as in a traditional face-to-face class, which could be reflected with the coursework content or portfolio that students generated
- Faculty should achieve equal student evaluations for a course whether it was taught blended or fully online or face-to-face.

Although the use of Elluminate Live! will not guarantee the success of an online or hybrid class, it will increase the chances of success of that class if it's use is well planned and implemented correctly. In order to do so, the instructor needs to understand the tool and how to use it to its potential. The material presented in this paper should help prepare instructors to use Elluminate Live! successfully in their online or hybrid teaching endeavors.

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STARTING OUT ON THE RIGHT FOOT:
EVALUATING THE PERFORMANCE OF FIRST SEMESTER FRESHMEN IN A SKILLS-BASED COMPUTER
COURSE

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ABSTRACT

Although starting college is an exciting time for most students, it brings a number of challenges. As students struggle to adapt both to their new environment and to the academic demands, their class performance may suffer. This paper examines the academic performance of first semester freshmen in a hands-on, skills-based computer applications course. We find that new freshmen perform significantly worse in the course than do more experienced students. We use these findings as the basis to suggest possible interventions that may help to increase student performance.

INTRODUCTION

The first semester of college is a time of considerable transition for most students. Many of them are away from home for the first time and facing the challenge of managing their time and juggling responsibilities. Students must adapt both to new social relationships and to increased academic demands (Tao, Dong, Pratt, Hunsberger and Pancer 2000; Friedlander, Reid, Shupak and Cribbie 2007). Those students who struggle with course requirements early on are likely to face greater challenge in future semesters as they must often repeat failed courses or attempt to earn higher grades to offset low grade point averages.

The purpose of the current study is to examine the success rates of students in a hands-on, skills based computer course that covers topics in Microsoft Excel and Microsoft Access. Because of the hands-on nature of the course, it demands extensive outside class work. This is a required course for all business majors and a passing grade (C or better) is a prerequisite for several other business courses. The course is typically taken by students in their freshman or sophomore year. The authors of this paper have noted anecdotally that students in the first semester of their freshman year appear to have greater difficulty in keeping up with the required workload and submitting assignments on time. We wish to determine whether these students exhibit lower pass rates (defined as earning a grade of A, B, or C) in the course than students at a later stage in their academic career. If we can establish that first semester freshmen exhibit poorer performance in this course, then we can begin to test interventions designed to help those students increase their level of performance. The hypothesis to be tested is:

Hypothesis 1: The pass rate for first semester freshmen is lower than for other classifications of students.

METHODOLOGY

Course grades were collected for students enrolled in a Business Applications course in the fall semesters of 2007, 2008, and 2009. Values for student grades in the course, student classification, declared major, credit hours earned, and term were extracted from our university's data warehouse. A total of 2,282 course attempts are included in the analysis. We chose to collect data from the fall semester of each year in order to capture the greatest number of first semester freshmen. These students were identified by their designated class standing and by the number of credit hours earned.

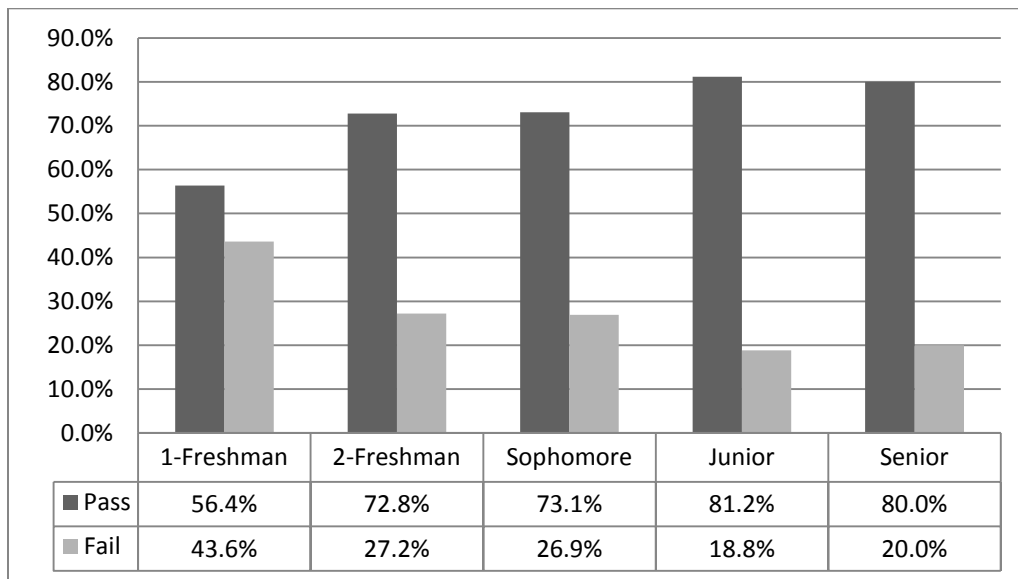
Freshmen were counted as being in their first semester if they had earned 15 or fewer credit hours up to and including the semester in which the reported grade was earned. Freshmen were counted as being in their second semester if they had earned more than 15 credit hours. A course load of 15 hours is typical for freshmen at our institution. Freshmen who have accumulated more than 15 hours have typically done so either by taking summer courses or by taking advanced placement courses. Thus the fall semester of their freshman year is not their first semester. All other students are categorized according to their class standing. Table 1 shows the distribution of students by classification.

The grades used in the study were earned in a required course for all students pursuing a business major. 2,013 (88.21%) of the grades in the data set were from students with a declared business or pre-business major. The remaining grades were earned by students with a variety of other majors across campus as well as students who had not yet declared a major or those with interdisciplinary or general studies majors. No major (other than business) accounted for more than 3% of the sample.

Table 1 – Breakdown of students by classification

Classification	Number of Students
1 st Semester Freshman	369
2 nd Semester Freshman	393
Sophomore	954
Junior	441
Senior	125
Total	2,282

Figure 1 – Pass/Fail Rates by Classification



In analyzing the data, we chose to examine the rate at which students pass or fail the course. The business curriculum specifies that students must earn a C or better in this course so grades of A, B, and C are defined as passing while grades of D, F, or W (withdrawal) are defined as failing. We chose to use pass rate as the dependent variable for this analysis instead of course grade because it clearly captures the distinction between students who have successfully completed the course and those who must repeat it. Figure 1 illustrates the pass rates by student classification. First semester freshmen have the lowest pass rate with just over half (56.4%) successfully completing the course.

Table 2 – Chi Square Test

	Observed Frequency f_i	Expected Frequency e_i	$(f_i - e_i)$	$\frac{(f_i - e_i)^2}{e_i}$
1 st Semester Freshman	208	266.6	-58.6437	12.8977
2 nd Semester Freshman	286	284.0	2.0136	0.0143
Sophomore	697	689.4	7.6284	0.0844
Junior	358	318.7	39.3282	4.8536
Senior	100	90.3	9.6735	1.0360
Totals	1,649	1,649		18.8860
				0.0008

We evaluated our hypothesis by performing a chi-square goodness of fit test as shown in Table 2. Values shown in the Observed Frequency column represent the number of passing grades in the data set. Values shown in the Expected Frequency column were computed as the number of students in each classification multiplied by the overall pass rate of 72.3%. We then computed the chi-square statistic as $\chi^2 = \sum \frac{(f_i - e_i)^2}{e_i}$ (Hansen 2010). The value of the chi-square statistic is 18.886 and it is significant at $p < 0.001$, thus indicating that the observed frequencies across classifications are not equivalent. The pass rate observed frequency for first semester freshman is lower than the expected frequency; for all other classifications, the pass rate observed frequency is higher than the expected frequency. Thus, the hypothesis is supported.

DISCUSSION

The findings of this study indicate that first semester freshmen taking a skills-based computer course exhibit significantly lower performance than do students in their second semester of college and beyond. These findings confirm our anecdotal observations that this group of students has a greater tendency to fall behind on assignments, miss assignments, and earn lower exam grades. Based on these findings, we intend to explore ways in which we might alert first semester students to the demands of the course and help them achieve a higher level of performance.

We base our discussion of possible interventions on a review of relevant literature. Randall S. Hansen, Ph.D., founder of Quintessential Careers states that students can “survive and thrive in their freshmen year and beyond” by “getting organized, finding an ideal place to study, going to class, becoming an expert on course requirements and due dates, meeting with professors, and taking advantage of student resources on campus such as tutors and learning labs (Hansen 2010).” He further encourages students to practice good time management skills, manage social and employment relationships effectively, and stay healthy (Hansen 2010). We propose an intervention whereby we, as instructors, develop a plan to help students become “experts” on our course, practice good time management skills, and help them take advantage of campus computing resources. This plan could include face-to-face progress meetings with struggling students to encourage them to take advantage of available resources.

Other researchers indicate that early intervention with struggling students may help them to correct problems that, if ignored, could hinder their academic careers (Beck and Davidson 2001). A study conducted of students seeking assistance through the Tutoring Center at Western Washington University concluded that “students who made use of the Tutoring Center regularly gained more academically than simply help with an individual class” (Cooper 2010). Cooper found that students who visited the Tutoring Center more than 10 times per term (approximately once per week) had “statistically higher rates of persistence and were statistically more likely to be in good academic standing” than students who did not take advantage of that resource (Cooper 2010). We propose an intervention to study the effect of peer-tutoring on the academic progress of freshmen taking our course. We would seek to create an effective peer-tutoring environment, train peer tutors, and track and report the academic progress of freshmen who seek peer-tutoring assistance.

Although today’s students are technologically savvy in some areas (for example, music downloads, text messaging, and accessing Web 2.0 technologies), there is evidence to indicate that this expertise does not translate into a broad based knowledge of technology that would be useful in a computer applications course (Case, MacKinnon and Dyer 2004; Messineo and DeOllos 2005). A review of the relevant literature indicates that often, a student’s fear of using computers or computer phobia (Rosen, Sears and Weil 1987; Rosen 1992) affects his or her academic performance in computer-intensive courses like the one examined in the current study. Further, this fear combined with a student’s low computer self-efficacy may cause him or her not to take full advantage of a university’s computer facilities (Mcilroy, Sadler, Boojawon, 2005) and may contribute to slower and more error-prone task performance (Paxton and Turner 1984; Kanfer and Heggestad 1997). In order to maximize their learning experience using computers, students must possess both the cognitive skill and the motivational will to succeed (Pintrich 2002). Linnenbrink and Pintrich (2002) state that because student motivation is a “more situated, contextual, and domain-specific” individual trait, students’ own thoughts about their motivation and learning play a key role in mediating their engagement and subsequent achievement (Linnenbrink and Pintrich 2002, p. 314)

A possible intervention to help with fundamental computer skills might involve evaluating incoming students’ computer knowledge. Ratliff (2009; 2009) finds that “testing the technological readiness of incoming freshmen may help explain the disconnect between faculty expectations of

students' computer knowledge and skills and what students actually know." Ratliff states that in addition to evaluating incoming freshmen on the 3 R's of Reading, Writing, and Arithmetic, we should add a fourth "R" of technology readiness. We find the results of Ratliff's research promising and feel that a readiness intervention such as the one she conducted at Mountain Empire Community College may be effective in understanding freshmen failure rates in the course examined in the current paper.

SUMMARY

Academic performance of incoming college freshmen has been an issue of concern for many years (e.g., Larsen, Wittenborn and Ciesecke 1942; Mancott 1968) and continues to be today (Klopfenstein and Thomas 2009; Diseth, Pallesen, Brunborg and Larsen 2010). In this paper, we have demonstrated that first-semester freshmen performance in a skills-based computer course is lower than students who take the course later in their academic career. This is the first step of a larger study in which we hope to design and evaluate interventions that can alert incoming students to the demands of the course and help them to work towards greater achievement as they complete the course.

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A RUBRIC FOR EVALUATING STUDENT ANALYSES OF BUSINESS CASES

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ABSTRACT

A rubric for evaluating student analyses of textbook cases is presented. The rubric emphasizes the synthesis of course concepts, analysis of facts, and business judgment. It supports AACSB requirements to teach analytic skills and written communication. The rubric is designed for use in courses where the required analysis is primarily qualitative. It is not restricted to a single business discipline, and it does not require all case analyses to have the same organizational structure. The rubric has been tested in an International Management course, with promising results.

INTRODUCTION

A rubric is a set of guidelines or instructions for assessing student performance, including expectations and evaluation criteria [9]. Rubrics are used to communicate expectations to students, assess student performance, and give feedback to students [2][12]. This paper presents a rubric for evaluating student analyses of textbook cases in those upper-level undergraduate courses where the required analysis is primarily qualitative, rather than quantitative. Many cases in marketing, management, and business ethics fit this description. The rubric is also designed to support AACSB and university learning goals for critical thinking and written communication.

PROBLEM STATEMENT

The authors teach courses in business ethics and international business; we frequently assign written analyses of textbook cases. There were several concerns about the quality of the case work that we received. Some students did not understand theories and concepts from the assigned articles or chapters related to the case. Others misunderstood important facts in the case, omitted significant issues, did not consider the context of the case, or failed to use critical thinking skills from their general education courses; these mistakes led to erroneous, incomplete, or off-target analyses of the problems and issues in the case. All these errors, along with poor business judgment and illogical reasoning, sometimes led to inappropriate conclusions or recommendations. In other words, there was not a convincing, logical synthesis of course theories and concepts, the facts in the case, and good business judgment. An additional problem is that some case assignments were poorly organized or were not written in a professional manner.

The authors have attempted to address these problems by clarifying expectations and by providing extensive written and verbal feedback; these efforts have been partially successful. The authors believe that the next logical step in improving student learning is to use a rubric to grade student performance and provide feedback to students. In an effort to locate a suitable rubric, the Web sites of AACSB, Winona State University, and Portland State University were searched. Two books on rubric construction and use were also consulted [12] [15]. The most promising rubrics for business case assignments were those developed by Nielsen [7], Singer [11], the University of Dayton [13], and the University of Scranton [14]. The authors of this paper concluded that none of these rubrics fully met the need for a rubric that could be used with textbook cases in multiple business disciplines and also reinforced critical thinking and writing skills; the reasons for this conclusion will be discussed in the review of literature. However, all four

published rubrics contained some ideas or descriptions of student work that were useful in developing a new rubric.

REVIEW OF LITERATURE

The Importance of Critical Thinking and Writing

A written case analysis requires students to think critically and translate the results of the thinking process into a document that is accurate, persuasive, and well-written. The importance of writing and critical thinking in university education has been recognized by the American Association of Colleges and Universities (AACU) [10] and AACSB International [1]. AACSB Accreditation Standard 15 for Business Programs lists "communication abilities" and "analytic skills" as skill areas that would normally be included in an undergraduate business curriculum [1, p. 72]. AACU sponsored a project called Valid Assessment of Learning in Undergraduate Education (VALUE); this effort resulted in the development of rubrics to assess student learning in twelve key areas, including critical thinking and written communication [10]. The contribution of these two rubrics to the authors' case analysis rubric will be described in the section on rubric development.

At the authors' university, writing and critical thinking are key components of general education and business degree programs. The general education (Touchstone) goal for communication states that students should "communicate clearly and effectively in standard English"; this goal includes both written and oral communication. The College of Business Administration goal for written communication is, "Students will be able to demonstrate persuasive communication skills by researching, organizing, and writing an effective document in a professional manner." These goals emphasize the importance of using standard English, clarity, persuasive writing, and writing in a professional manner; these ideas will be used in the case analysis rubric.

At the authors' university, a general education (Touchstone) goal requires students to "use critical thinking, problem-solving skills, and a variety of research methods". The College of Business Administration goal for critical thinking is, "Students will be able to demonstrate critical thinking strategies by applying solutions to unstructured problems." Nosich [8] discusses critical thinking skills; these skills include understanding and applying concepts, using information, identifying issues, considering context, understanding the implications and consequences of decisions or positions taken, and drawing conclusions. The first four skills in this list will be explicitly mentioned in the case analysis rubric; the last two are an implicit part of business judgment.

The Structure of Three-to-Five Level Rubrics

Several different types of rubrics can be found in the literature. Three-to-five level rubrics are often used for communicating expectations to students, grading, and giving feedback to students [12]. These rubrics are also called multi-level analytic rubrics. They usually have three parts: dimensions or task elements on which student performance will be measured, a scale that specifies various levels of performance, and descriptors of each level of performance on each dimension. For instance, the case analysis rubric used at the University of Scranton [14] has five dimensions and three levels of performance; the format for this rubric is shown in Table 1.

The cells in the rubric contain descriptions of performance on each dimension at various performance levels. For instance, the University of Scranton [14] rubric defines Exemplary performance on the Issues dimension as "Recognizes multiple problems in the case. Indicates some issues are more important than others and explains why". As the name three-to-five level rubric indicates, most multi-level analytic

rubrics include three, four, or five performance levels. Each dimension should be described in a way that clearly differentiates every performance level from other levels [4].

Table 1: Format for the University of Scranton Case Analysis Rubric

DIMENSION	Unacceptable	Acceptable	Exemplary
Issues			
Perspectives			
Knowledge			
Actions			
Consequences			

A variety of rubric scales have been used. Table 2 summarizes the scales used in the four business case analysis rubrics mentioned earlier, the VALUE rubrics for critical thinking and written communication, and three rubrics for written communication that have been used at the authors' university.

Table 2: Scales Used in Selected Rubrics

Rubric	Performance Levels	Scale
Nielsen, Business Case Analysis [7]	3	Exceeds Standards, Meets Standards, Fails to Meet Standards
Singer, Business Case Analysis [11]	5	1, 2, 3, 4, 5 – No descriptions of performance levels. It is not clear whether 1 or 5 is the highest level.
University of Scranton, Business Case Analysis [14]	3	Unacceptable, Acceptable, Exemplary
University of Dayton, Business Case Analysis [13]	2 or 3	Each dimension is divided into sub-dimensions. Scale of 2, 1, or 0 points for some sub-dimensions Scale of 1 or 0 points for other sub-dimensions
VALUE Rubrics for Critical Thinking and Written Communication [10]	4	Capstone (4), Milestones (3), Milestones (2), Benchmark (1) A score of zero is suggested for work that does not meet Benchmark standards.
Winthrop University, Touchstone Writing Competency Rubric [16], and Winthrop University, New Writing Rubric for Human Experience 102 [17]	5	Substantially Exceeds Requirements, Exceeds Requirements, Meets Requirements, Partially Meets Requirements, Does Not Meet Requirements
Judge, Rubric for Grading Research Papers [5]	5	Excellent, Very Good, Adequate, Minimal Pass, Unsatisfactory. Equivalent grades (A to F) are also listed.

Existing Rubrics for Business Case Analysis

This section provides more detailed descriptions of the rubrics for business case assignments that were developed by Nielsen [7], Singer [11], the University of Scranton [14], and the University of Dayton [13]. The suitability of these rubrics for evaluating student performance on textbook cases that do not require quantitative analysis will be discussed. The ability of these rubrics to address the concerns raised in the problem statement above will also be considered.

Both Singer [11] and Nielsen [7] developed rubrics for business strategy cases. In each of these rubrics, the dimensions are a well-developed sequence of steps for completing a comprehensive strategic analysis. Both rubrics include wording that requires a knowledge of theories and concepts, critical thinking, and the use of appropriate analytic tools. In the Nielsen [7] rubric, the highest level of performance requires a

synthesis of theories, facts, analysis, and business judgment. A limitation of the Singer [11] rubric is that its dimensions are specific to strategic analysis, and it would be difficult to adapt them to other types of cases. Another concern is that performance levels for the dimensions are not described. The Nielsen [7] rubric may be more adaptable, since its dimensions could probably be used with cases in other fields. For some dimensions, the descriptions of performance levels in Nielsen [7] are tailored to strategic analysis; those descriptions would require substantial revision for use in other business disciplines.

The Singer [11] and Nielsen [7] rubrics appear to be designed for the types of cases that are published by organizations such as the Harvard Business School Press, the Ivey School of Business at the University of Western Ontario, and the European Case Clearing House. These cases usually have a broad scope and provide large amounts of qualitative and quantitative data; this information supports an in-depth analysis of the problems or issues in the case. In the courses that the authors teach, textbook cases are usually more tightly focused, shorter, and provide less data; consequently, students' analyses of these cases have less breadth and depth. Although the Singer [11] and Nielsen [7] rubrics have many strong points, the authors believe that neither is well-suited to typical textbook cases. However, each of these rubrics includes language that can be useful in rubrics for other business disciplines.

Case analysis rubrics used at the University of Scranton [14] and the University of Dayton [13] were also reviewed. As stated earlier, the University of Scranton [14] rubric has five dimensions: Issues, Perspectives, Knowledge, Actions, and Consequences; the performance levels are Unacceptable, Acceptable, and Exemplary. The University of Dayton [13] rubric starts with the University of Scranton [14] rubric and adds sub-dimensions for each dimension; as shown in Table 2, each sub-dimension is scored on a numerical scale. Both rubrics recognize the need to link facts and analysis with theories and concepts. The Dayton rubric also stresses accurate use of theories, concepts, and facts; a limitation of the Scranton rubric is that it does not mention accuracy. One strength of both rubrics is that they could be used with non-quantitative cases in a variety of business disciplines; they are probably best-suited to cases where the required analysis is aligned with the dimensions of the rubrics.

The authors decided not to use either the Scranton [14] rubric or the Dayton [13] rubric, because the dimensions used do not align well with some of the cases that we use. For instance, some international management cases require students to look at past events and use course concepts to explain why a company's decisions led to poor results; recommendations in those cases usually involve straightforward advice about making better decisions in the future. The Scranton and Dayton rubrics do not fit well with this case structure. The authors did identify some language in the Scranton and Dayton rubrics that was useful in constructing a new rubric.

CONSTRUCTING A NEW RUBRIC FOR TEXTBOOK CASES

The first step in rubric construction was to identify performance-related dimensions. Every business case rubric in the review of literature used dimensions that were based on a common, content-related sequence of analytical steps that was used to evaluate all assigned cases. The authors analyzed the cases in a recent business ethics textbook [3] and a current international management textbook [6]. It was found that the cases in these textbooks do not require a consistent, content-related sequence of analytical steps. It was necessary to take a different approach to developing performance dimensions; this approach included consideration of the strong points in the rubrics reviewed above, and a review of the problems in student case work that were identified earlier in this paper. Four content-related performance dimensions were identified; these were (1) understanding and application of course theories/concepts, (2) case analysis, (3) business judgment, and (4) synthesis of course theories/concepts and case analysis. In addition, a decision was made to include dimensions related to organization, writing style, and mechanics; the dimensions for these characteristics were identified later in the rubric development process.

A decision was made to use a five-level scale for the rubric. A five-level scale was attractive because students and faculty can easily relate the five levels of performance to the traditional A-F grading scale. It seemed likely that five levels of performance could be defined and differentiated for the content-related dimensions. The rubric review included three rubrics that used five-level scales; none of the rubrics had more than five levels.

The next step was to select names for the performance levels. Nielsen [7] used a scale based on meeting standards; two of the writing rubrics in Table 2 used scales based on meeting requirements. Scales based on meeting standards, requirements, or expectations provide a link between the expectations in the assignment and the rubric. The authors decided to use a scale based on meeting expectations, which corresponds to the scale used for performance evaluation in many work places.

After the scale had been selected, the next task was to review the rubrics listed in Table 2 for descriptions of student performance that would be useful in describing the four content-related performance dimensions of the new rubric. The results of this analysis are shown in Table 3. For each of the dimensions, relevant descriptions of student performance were found in at least two of the four rubrics for business cases; synthesis was included in all four.

Next, five levels of performance were described for each of the four content-related dimensions. The ideas in Table 3, related information in the rubrics, and the authors' experience in grading case assignments were used to do this.

Table 3: Review of Existing Rubrics

Rubric	Course Concepts	Case Analysis	Business Judgment	Synthesis
Business Case Analysis, Nielsen [7]	Use of theories and concepts	Complete development of information	Thorough application of related concepts and judgment.	Integration of theories and concepts with analysis. Convincing reasoning.
Business Case Analysis, Singer [11]		Sufficient, specific analysis	Logical reasoning. Accurate use of course material.	Considers the context of the case.
Business Case Analysis, University of Dayton [13]	Accurate use of theories/concepts	Accurate use of facts in the case		Analysis linked with main theories/ concepts
Business Case Analysis, University of Scranton [14]				Discusses facts of the case in relation to research.
VALUE Rubric for Critical Thinking, AACU [10]		Use of evidence	Awareness of assumptions	Relevance of context. Limits of position.
VALUE Rubric for Writing, AACU [10]				Awareness of context
Winthrop University, Touchstone Writing Competency Rubric [16]		Insightful. Uses relevant details.		Relevant. Convincingly interpreted
Winthrop University, New Writing Rubric for Human Experience 102 [17]				Convincing interpretation
Judge, Rubric for Grading Research Papers [5]		Use of details		Logical conclusions, based on theory and evidence

The next task was to select dimensions for organization, writing style, and mechanics. All four writing rubrics had dimensions for these characteristics; the only business case rubric that considered these issues was Singer [11]. In the New Writing Rubric for Human Experience 102 [17], the Organization dimension

was based on the concept of organizational strategy, which should "create a persuasive logical flow" and "contribute to meaning". The name Organizational Strategy was chosen for the organization dimension of the new rubric; descriptions of the five performance levels were adapted from the Human Experience Rubric [17] and the Touchstone Writing Competency Rubric [16]. The assumption that organization contributes to meaning affected the placement of the Organizational Strategy dimension in the rubric; this dimension is in the Content and Analysis section, rather than the Style and Mechanics section.

The Style and Mechanics section of the rubric is based on the Touchstone Writing Competency Rubric [16]. Descriptions of the performance levels were revised to emphasize professional vocabulary and a writing style that is appropriate for business documents. The completed rubric is shown in Table 4, which continues on the next page.

Table 4: Case Rubric

Assignment					
	Substantially exceeds requirements	Exceeds requirements	Meets requirements	Meets minimal requirements	Minimal requirements not met
Analysis and Content					
Understanding and application of course theories/concepts	Excellent knowledge of the theories/concepts shown.	Very good knowledge of the theories/concepts shown	Adequate knowledge of the theories/concepts demonstrated.	Several errors or omissions in knowledge of theories/concepts.	Fails to demonstrate knowledge of the theories/concepts.
Case analysis	Insightful throughout . Completely developed all relevant information.	Specific, solid. Less carefully developed. Some insight.	Appropriate. Lacks depth or should be more specific. Identified only the main issues.	Vague, obvious, underdeveloped, or too broad. One or more main issues not identified. Limited evidence of critical thinking.	Several main issues not identified. Oversimplified, vague, unclear, or cannot be understood. Little or no evidence of critical thinking.
Business judgment	Thorough understanding of the application of related business concepts and judgment to the case.	Good business judgment, logical reasoning, and some understanding of related course concepts.	Some sound business reasoning applied.	Shows limited application of business reasoning. May have a few minor errors of fact.	Inappropriate, and/or off-topic generalizations, faulty assumptions, or major errors of fact.
Synthesis of course theories/concepts and case analysis	Convincingly interpreted and linked to theories/concepts. Considers context and limits of position where appropriate.	Relevant. Appropriately interpreted and linked to main theories/concepts.	Some obvious or superficial connections to theories/ concepts.	A few generalized connections made. Connections not clearly linked to case.	No clear connections between the facts of the case and relevant theories/ concepts.
Organization	Organizational strategy creates a persuasive logical flow with smooth transitions.	Organizational strategy contributes to understanding. Most transitions are smooth.	Appropriate but unevenly developed. Should do more to support the logical flow of the paper, May have a few awkward/missing transitions.	Inappropriate and/or inconsistent organization. Hard to follow the logical flow. Several poor/missing transitions	No organizational strategy is evident. Rambles. Connections between paragraphs are confusing. Sentences within some paragraphs are unrelated.

Table 4: Case Rubric (continued)

Style and Mechanics					
Sentences	Varied, appropriately complex and clear; controlled, and employed for effect.	Some variety and complexity. Uneven control. Overall, most sentences clearly express ideas.	Limited variety, simple structure, unsophisticated.	Little variety. Poorly developed sentences.	Superficial or stereotypical language.
Vocabulary	Precise, appropriate, advanced, and professional vocabulary.	Accurate, generally appropriate, less advanced or precise.	Some oversimplified language. May rely on clichés.	Language is oversimplified or inappropriate in a business document	Oral rather than written language patterns predominate.
- Grammar - Spelling/Usage - Punctuation	Essentially error free. Carefully edited.	Very few errors. Carefully edited.	Errors do not interfere with readability. Shows evidence of some editing.	Errors interfere with readability. Not always consistent with Standard Written English.	Numerous errors interfere with reader comprehension. Consistently awkward; difficult to understand.
Documentation of resources (if applicable)	Thoroughly documented in proper format.	Sources are almost always carefully documented.	Sources mostly documented, occasional misses.	Sources are poorly documented.	Documentation is inappropriate or absent.

Most of the rubrics that were reviewed did not assign points or weights to the performance dimensions; the two exceptions were the case analysis rubrics developed by Nielsen [7] and the University of Dayton [13]. The rubric developed in this paper does not include points or weights. In the authors' experience, a case analysis should be graded as a whole, rather than as a collection of discrete pieces, each of which can earn a certain number of points. For example, in an ethics case, a student took a quote from Adam Smith that was written in the 1770's, used it out of context, and wrote a complete case analysis based on the incorrect assumption that insider trading is legal. This false assumption made the entire submission unacceptable, even though "faulty assumptions or major errors of fact" is mentioned in only one cell of the rubric. The grade the student received was not a weighted average of performance on the individual dimensions, since his performance on the Business Judgment dimension was wholly deficient. The assumption of legality led to errors in the case analysis, synthesis, and conclusions. This type of "spillover effect" is hard to capture in a system of points or weights.

The inclusion of writing in the rubric is based on the assumption that business documents should be professional and well-written. However, good writing is only one characteristic of a good case analysis. If a well-written paper does not meet the requirements in the Analysis and Content section of the rubric, those deficiencies must be considered in determining the grade; the rubric provides a basis for assigning an appropriate grade.

TESTING THE RUBRIC

The rubric has been tested in a 500-level International Management class that included one junior, nineteen seniors, and five graduate students. The undergraduates included seven in the International Business concentration, eight in the Management concentration, and five in General Business. The graduates included three MBA students in the International Business concentration, one in the general MBA program, and one in the Master of Arts in Teaching program. Some students had a significant amount of international experience, while others had none. Students who have not had international experience often have more difficulty understanding the context of global business.

Using the rubric for grading had several advantages. In the opinion of the author, factual errors decreased markedly; the percentage of case analyses that did not consider the context of the case also decreased. Students used more course concepts and were more likely to use them correctly. Writing style and mechanics also improved. In addition, the rubric made it easier to grade students consistently.

Using a rubric does not eliminate the need for faculty judgment. For instance, how much knowledge of course concepts is adequate in a particular case? Another example concerns students who show good knowledge of course concepts but do not apply them correctly in the context of the case. Regardless of the grading system used, the faculty member must decide how to balance the strong and weak points of the students' work in assigning a grade.

Stevens and Levi [12] suggest that using a rubric reduces the time required for grading. They recommend giving feedback to students by marking a copy of the rubric for each student, showing the performance level for each dimension; if additional feedback is needed, written comments can be made on the rubric copy. However, the authors are concerned that some students may not be able to link the feedback on the rubric copy to specific errors and omissions in their papers. Consequently, both authors usually write comments on student papers; one of the authors also marks the rubric to indicate student performance levels. Some of the authors' colleagues also write comments on student papers; others simply return marked rubrics to students. Faculty members who grade with rubrics need to make judgments about how much feedback students need in a particular course.

At the authors' university, rubrics are used in three required writing courses and a number of other general education courses. Students understand that a rubric specifies performance expectations and that they will be graded accordingly. If marked rubrics are returned with an assignment, most students will examine them carefully. Faculty members who teach at universities where students are less familiar with rubrics would probably need to explain why a rubric is being used, what the expectations are, and how students can use the rubric to understand their grades and improve their work.

SUMMARY

A rubric for evaluating student analyses of textbook cases has been presented. The rubric emphasizes the synthesis of course concepts, analysis of facts, and business judgment. It supports AACSB requirements to teach analytic skills and written communication. The rubric is designed for use in upper-level courses where the required analysis is primarily qualitative, rather than quantitative. Many cases in marketing, management, and business ethics fit this description. The rubric is not restricted to a single business discipline, and it does not require all case analyses to have a similar organizational structure.

The rubric has been tested in a 500-level International Management course. The instructor believes that using the rubric improved the quality of student work and made it easier to grade consistently. Additional testing is needed before firm conclusions can be drawn about the usefulness of the rubric.

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CAN STUDENT EVALUTIONS OF TEACHING BE TOO GOOD?

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ABSTRACT

The interpretation and reliability of student course evaluations can be hampered if the variance is artificially reduced by a halo effect, in which students use a single overall impression of the course and instructor to respond to all items in a survey, rather than responding to individual aspects. This study examined the existence and reasons for halo effects in course evaluations. In our university, over the past seven semesters, thirty-four percent of all course evaluations contained the highest scores possible on all aspects. Results suggest that the halo effect does indeed exist and is driven by specific impressions on the part of students. In this study, we discuss the prevalence, reasons for, and implications of this halo effect in student evaluations of teaching.

INTRODUCTION

Effective teaching has many definitions [4]. As a result, there is little agreement in how to evaluate teaching effectiveness. Agreement centers on the ideas that institutions should first identify the uses of their evaluation system and should formulate their own system that includes student input. In an increasingly customer-centric system of higher education, it is difficult to argue against giving students an opportunity to provide feedback on their perceptions of the education they are receiving. There is a large body of work that questions how student feedback should be collected and interpreted and how that information should be used (e.g. promotion and tenure decisions).

Much of the work on the interpretation and reliability of student course evaluations uses variance-explaining methods. This approach can be hampered if the variance is artificially reduced by a halo effect, in which students use a single overall impression of the course and instructor to respond to all items in a survey, rather than responding to individual aspects. If the halo effect is a tendency toward higher scores, then a “perfect score” on an evaluation may represent the extreme case of the halo effect.

In our university, course evaluations are conducted at the end of each semester for every course. Students are asked to rate their agreement with each of sixteen aspects of the course and

instructor on a five-point scale. Contrary to what would be predicted by chance, over a seven semester period, thirty-four percent of all course evaluations contained the highest scores possible across every item in the evaluation. Although we might aspire to having students who are raving fans, this type of response confounds other analyses, and may be due to reasons other than the students' perception of the highest level of excellence in the course and instructor.

In the remaining sections, a brief review of relevant literature from a vast body of work on student course evaluations is presented. We then identify the frequency of the perfect score phenomenon overall and within student sub-groups. A survey instrument designed to elicit why students give perfect scores is introduced. The findings from an analysis of this survey are presented. Conclusions and implications are discussed.

LITERATURE REVIEW

A considerable amount of research has focused on the reliability and validity of student evaluations. In an effort to clarify the issues surrounding student evaluations, Peterson, et.al. [6] developed a taxonomy of the literature based on a Journal Storage (JSTOR) search of student evaluations of teaching which returned over 5,200 listings. Using Peterson's taxonomy of the literature, the work reported here fits into the category "factors influencing students' ratings". They divide this category into teaching-related factors and non-teaching-related factors, with the latter group including semester, course session, faculty type, course level, course focus, and course type. They found that non-teaching factors could cloud the assessment of teaching-related factors.

In a specific test of factors that influence evaluations, Felton & Stinson [3] found that about half of the variation in students' evaluations of instructor quality could be explained by the students' ratings of the instructor's easiness and sexiness. They caution "If these findings reflect the thinking of American college students when they complete in-class student opinion surveys, then universities need to rethink the validity of student opinion surveys as a measure of teaching effectiveness" [3, p. 91]. Based on a review of the literature, Wright [8] also found that student consumers rate instructors using a different set of criteria than do faculty peers or administrators. He further suggest that students may, in fact, use criteria unrelated to learning and further, prefer styles detrimental to their learning.

The work of Shevlin, et. al. [6] suggests that there is a central trait which influences student's evaluations of the lecturer. They used a confirmatory factor analysis model of lecturer ability, module effectiveness, and lecturer charisma. They found that the charisma factor explained 69% of the variance in lecturer ability and 37% of the variance in module attributes. In a review and call for more research on course evaluations, Trout [7] suggested that "what numerical forms apparently measure is the degree to which students are happy or satisfied with the instructor (personality), the course (requirements), and the outcome (grade)."

While none of the reviewed studies directly tested the “halo effect” many of the factors used by students can be seen as ones that reflect a very general impression of a teacher, rather than specific instances of teaching effectiveness. The “halo effect” would be a clear result of positive impression formation applied to the evaluation instrument.

Feeley specifically addressed the halo effect in student evaluations as the “...individual rater’s failure to discriminate among conceptually distinct aspects of a stimulus person’s behavior” [2, p. 226]. He presents a detailed review of studies of the halo effect in psychological measurement. He found considerable overlap among factors related and unrelated to teaching effectiveness, content, and teaching behaviors. He concluded that student evaluations of teaching are influenced by a halo effect. The question then remains, to what degree might halo effects be evident in student evaluations and what factors may be driving this response bias.

METHODOLOGY

Our university is small, liberal arts, master’s university. The university uses an in-class survey administered at the end of each semester for students to rate sixteen aspects of the course and instructor (Appendix 1). The survey was developed in 1994. It was created using questions identified in the literature as exhibiting the highest validity and reliability, at that time. Students rate their agreement with these sixteen items on a five-point Likert scale. The survey is constructed in such a way that all items are positive expressions. Therefore, “strongly agreeing” (5 points) is the highest rating for each item and the maximum possible is 80 points, representing a “perfect score” of “all fives”.

A total of 37,800 student evaluations were completed during the seven fall and spring semesters from fall 2006 through fall 2009. Thirty-four percent of these evaluations had perfect scores (Figure 1).

There was no significant difference in frequency between business and non-business courses or between graduate and undergraduate courses. The proportion of business undergraduate perfect scores was significantly higher than in business graduate classes ($p < .001$). The proportion of non-business undergraduate perfect scores was significantly lower than non-business graduate classes ($p < .001$), (Table 1). Approximately one out of three student course evaluations contains all perfect scores, whether graduate or undergraduate and whether business or non-business.

Based on a review of the course evaluation instrument (Appendix 1), an experienced instructor would conclude that a perfect score on these criteria should be a very rare occurrence, unless the score is measuring something other than the items on the evaluation. A perfect score (all 5’s) is seen as the most likely and most strongly expressed halo effect. We felt the most direct way to understand why students strongly agree with all items on the survey was to ask them. A survey instrument (Appendix 2) was created to elicit the reasons that students would answer all questions as “Strongly Agree”.

FIGURE 1: FREQUENCY DISTRIBUTION OF EVALUATION SCORES

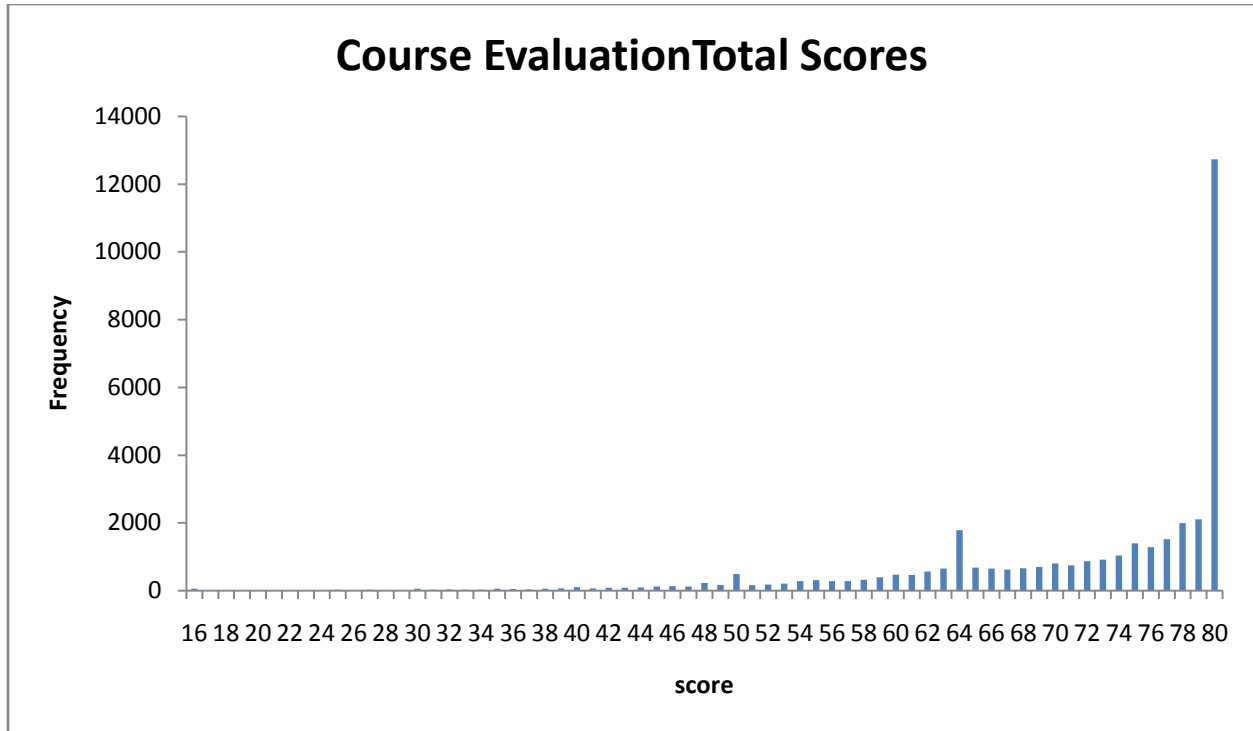


TABLE 1: FREQUENCY OF PERFECT EVALUATIONS

	Undergraduate	Graduate	Total
Business	1,111 (35.5%)	517 (29.4%)	1,628 (33.3%)
Non-business	10,539 (33.6%)	568 (37.8%)	11,107 (33.8%)
Total	11,650 (33.7%)	1085 (33.2%)	12,735 (33.7%)

The survey was a voluntary, anonymous questionnaire presented to all non-freshman students in a random sample of (ten) 200, 300 and 400 level undergraduate courses in the fall 2010 term. The total enrollment of these courses was 196. Freshman students were excluded since they had not yet completed an end-of-course evaluation. The survey asked students, “Have you ever completed a university course evaluation and responded to all items as ‘Strongly Agree?’” If so, they were asked to rate the importance of each of fourteen reasons that might have contributed to their behavior of responding to all course evaluation items as “strongly agree”. Space was provided for students to add additional reasons and to rate the importance of those additional reasons. Forty-eight students in the study group were absent, freshmen, or elected to not complete the survey. The 148 responses (76% response rate) were distributed as shown in Table 2, where “Yes” indicates they responded to all items as ‘Strongly Agree on at least one university course evaluation.

TABLE 2: FREQUENCY OF RESPONSES (N=148)

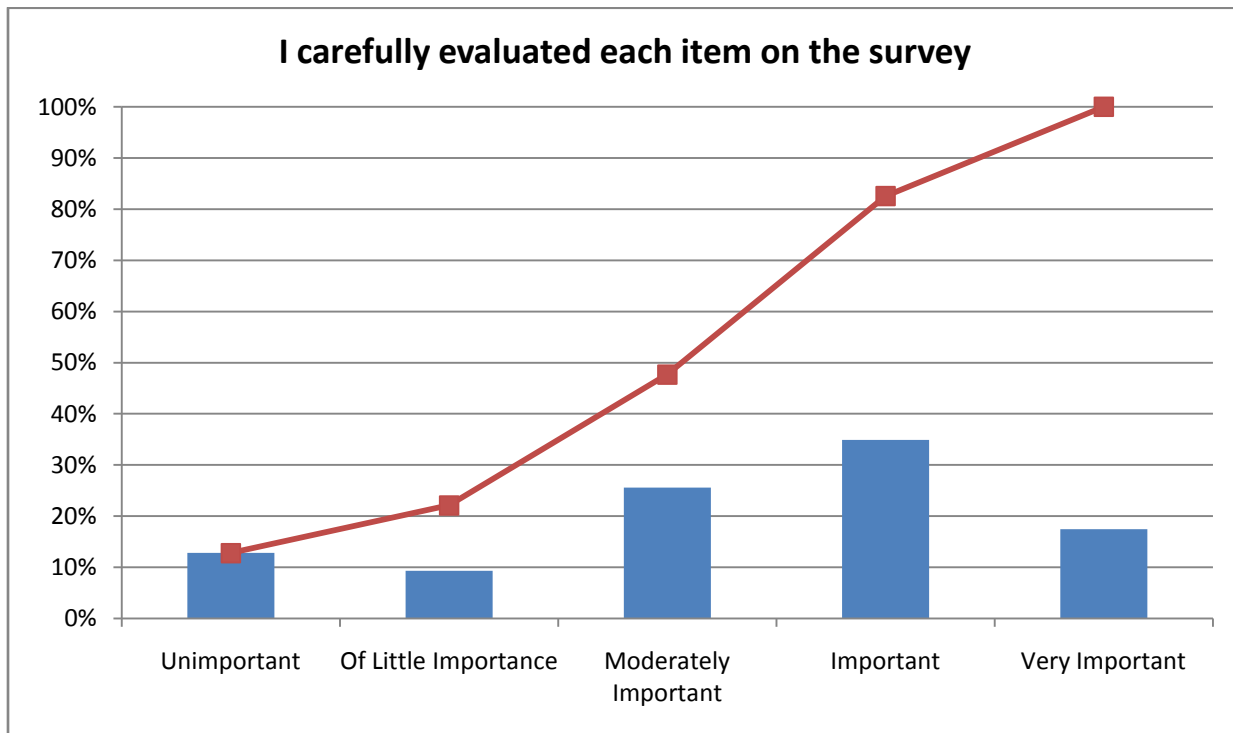
	Sophomore	Junior	Senior	
No	42%	43%	39%	41%
Yes	58%	57%	61%	59%
	22%	41%	36%	

FINDINGS

Fifty-nine percent of survey respondents indicated they had responded “Strongly Agree” to all items on a course evaluation at least once.

Forty-eight percent of those who gave perfect scores said a careful review of survey items had no more than a moderate impact on their decision to Strongly Agree with all items (Figure 2). In other words, almost half of the students admitted that their ratings were based on something other than the items they were rating, and they gave those ratings the highest possible scores. This is seen as clear evidence of a substantial halo effect in student course evaluations.

FIGURE 2: IMPORTANCE OF CAREFUL EVALUATION



The mean importance of carefully evaluating each item on the survey was just slightly below the importance of the instructor having a good sense of humor (Table 3). This difference was not

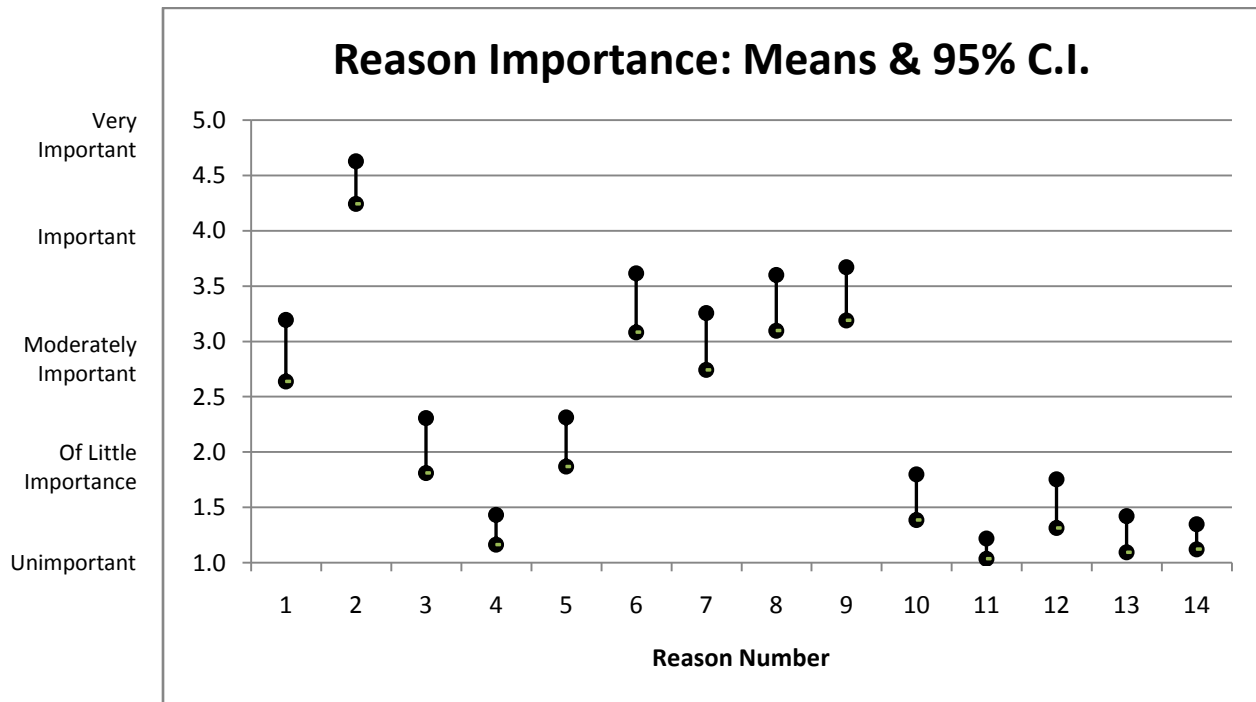
significant ($p = .60$). There was also no significant difference between the means of those two reasons and the instructor expecting a lot from the student.

TABLE 3: MOST IMPORTANT REASONS

Reason	Sample Mean	95% C.I.
2) I liked the instructor	4.4	4.2-4.6
9) The instructor had a good sense of humor	3.4	3.2-3.7
6) I carefully evaluated each item on the survey	3.3	3.1-3.6
8) The instructor expected a lot from me in the course	3.3	3.1-3.6

As shown in Table 3, the most important reason for strongly agreeing with all items was #2, “I liked the instructor.” The means and 95% confidence intervals for all reasons on the survey are shown in Figure 3.

FIGURE 3: REASON IMPORTANCE- MEANS AND 95% CONFIDENCE INTERVALS



Reason #3, “The instructor did not expect much from me in the course” (easiness) and #4, “The instructor was physically attractive” (sexiness) were of little importance and unimportant, respectively (Figure 3).

CONCLUSIONS AND IMPLICATIONS

A substantial halo effect was found within student course evaluations at our university. The most important reason given for this effect was “I liked the instructor”. One might be tempted to argue that students liked the instructor precisely because she is a good teacher. If this is true, then we cannot put much credence in what we as faculty feel are the characteristics of a good instructor (as listed in the course evaluations), since almost half of the students said those characteristics had no more than a moderate influence on their ratings.

This work has focused on the extreme case of the halo effect, where a perfect evaluation score is assigned by the student rater. It is reasonable to infer that the effect is even more widespread when one considers a tendency toward generally high scores in addition to the extreme (perfect) scores. For example, during the same study period, in five percent of course evaluations, students agreed (rather than strongly agreed) with each and every item on the evaluation, as demonstrated by the spike in frequency at a score of 64 (Figure 1).

It is reassuring that despite the earlier findings of Felton and Stinson [3], our research indicates that easiness and sexiness are of little to no importance as reasons to see a halo around the instructor. Less reassuring is the finding that a careful review of instructor performance (reason #6) is no more important than the instructor having a good sense of humor (reason #9).

The academy would be served by additional research into the prevalence of the halo effect reported here, as well as strategies to mitigate this effect. This effect might be better understood by investigating which students are more likely to assign a halo effect and which instructors are more likely to receive the halo effect. Also, if there is a halo effect in student course evaluations based on likeability, then is there a corresponding “horns” effect based on [dis]likeability?

If a university’s goal is to maximize student approval of instruction, then student course evaluation scores cannot be “too good.” The work reported here suggests that in our university overall student course evaluations would improve by screening faculty hires and rewarding current faculty for their “likeability”. This is a stark contrast to the behaviors we have been trying to measure, such as clearly stating course objectives on the syllabus, productive use of class time, and the other characteristics on the existing course evaluation (Appendix 1).

If, however, the university’s goal is not just student satisfaction per se, then perfect evaluation scores may be “too good” in the sense that they signal the presence of a halo effect. In this case, Felton & Stinson’s caution is profound: “High student opinion survey scores might well be viewed with suspicion rather than reverence, since they might indicate a lack of rigor, little student learning, and grade inflation” [3, p. 91]. In the presence of a halo effect, a reliance on student evaluations in compensation, promotion, and tenure decisions may reward and reinforce instructor behaviors quite different from those which the university intends.

APPENDIX 1: COURSE-INSTRUCTOR EVALUATION

(Strongly Disagree, Disagree, Neither Agree Nor Disagree, Agree, Strongly Agree)

1. Course objectives were clearly stated on the syllabus
2. Course requirements and grading system were clearly stated on the syllabus
3. Specific course content was related to the overall course objectives
4. This course significantly increased my understanding of the subject
5. This was an excellent course
6. Tests, projects, presentations, and papers were graded fairly
7. Tests and assignments were returned promptly
8. The instructor was well prepared for class
9. The instructor used class time productively
10. The instructor demonstrated knowledge of the subject
11. The instructor showed enthusiasm and genuine interest in this course
12. The instructor demanded the 'best work possible' from me
13. The instructor was courteous and respectful to students
14. I felt free to express ideas and ask questions in class
15. The instructor was available outside of class for help
16. This is an excellent instructor

APPENDIX 2: RESPONSE STYLE SURVEY

(Unimportant, Of Little Importance, Moderately Important, Important, Very Important)

1. I was in a hurry completing the survey
2. I liked the instructor
3. The instructor did not expect much from me in the course
4. The instructor was physically attractive
5. The course evaluations are meaningless
6. I carefully evaluated each item on the survey
7. I liked the subject before taking the class
8. The instructor expected a lot from me in the course
9. The instructor had a good sense of humor
10. I wanted the instructor to get a promotion or a pay raise
11. The instructor asked me to give those scores
12. I felt influenced by the instructor
13. The instructor stayed in the room during the evaluation
14. I didn't want to get the instructor in trouble

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SEDSI TUTORIAL

SEDSI 2011 Conference

Fumbling Around as a Teacher: What a Coach of 35 Years Has Learned About Facilitation as Leadership

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SESDSI TUTORIAL:

“Fumbling Around as a Teacher: What a Coach of 35 Years Has Learned About Facilitation as Leadership”

1. INTRODUCTION AND SOME HYPOTHESES.
2. SOME PERSPECTIVES ON FACILITATORS AS TEACHERS.
 - A. Three Ways We Learn.
 - B. Child and Young Adult/Adult Learning.
 - C. Some Techniques That Employ Young Adult/Adult Learning Techniques.
3. WHAT IS FACILITATION?
4. TECHNIQUES FOR EFFECTIVE FACILITATION.
 - A. Establishing A Comfortable Learning Environment.
 - B. Developing Participation.
 - C. How To Manage Over Participation.
 - D. Dealing With Aggressive Or Challenging Student Behaviors.
5. SOME PERSPECTIVES ON LEARNING VS. TEACHING.
6. STILL MORE QUESTIONS.

1. INTRODUCTION AND SOME HYPOTHESES

Do today:

Spend perhaps 45 minutes with my material as a way to stimulate you on this subject, then move on to your questions and comments as well as to some of my questions.

This material taken from facilitation training I received over 35 at the United States Military Academy at West Point, while at the National War College in Washington, during training by Zenger-Miller, a firm that trains facilitators and provides materials for developing managers, from my own facilitation experiences teaching in universities and training in corporate America, and from sessions at a SAMS Conference on Re-engineering Business Schools.

My hypotheses:

1. All our students, whether they be grown-up learners or younger learners, are impatient with lecture methods of instruction (I think TV has something to do with this). Both types of learners have short attention spans, are too restless for lectures, and expect educators to be either like the trainers they experience in corporate America or full of action as they have seen on television. The cardinal sin from their vantage point is to be "boring."

2. To meet the needs of these learners, academia is moving from a teaching to a facilitation style, a style that focuses not on lecturing but on leading students. This is happening because of increased access to information through electronic mediums, continued increasing costs of university education, and the predominance of non-traditional students.

3. To meet the future needs of students, we will be preoccupied with:

Learning outcomes,

Preparing students for "K through 90 learning,"

and critical thinking, that is, knowing what to do when you have no idea how to proceed on a task.

2. SOME PERSPECTIVES ON FACILITATION AND ADULT LEARNING.

A. Three Ways We Learn.

THREE WAYS WE LEARN

VISUAL -- LEARN BY IMAGES

AUDITORY -- LEARN BY LISTENING

KINESTHETIC -- LEARN BY EXPERIENCING AND DOING

EXPLAIN: essentially thinking on learning argues that we learn in one of three ways: visual, auditory, or kinesthetic. That means that we learn by seeing images, by listening, or by doing. Now to be sure we are not all one type. For example, I am a visual learner for the most part. However, to learn to use computer programs, I am primarily a kinesthetic learner -- that is, I have to experience and practice the skill. But I am not good at that -- to stay effective on a computer, I have to practice a lot.

B. Traditional (or child) Approaches and Facilitation.

CHILD AND YOUNG ADULT/ADULT LEARNING

Effective facilitation requires an understanding of learning theory. Young adults and adults learn, grow, and interact differently from children. Therefore, it is important to keep in mind the following differences between children and young adults/adults. If you recognize these differences, you will increase the effectiveness of learning.

CHILDREN

Uses a lecturer who imparts information.

Have little or no experience upon which to draw — are relatively “clean slates”.

Assume that teaching is the instructor's responsibility.

Have little ability to serve as a knowledgeable resource to other classmates.

Focus on content.

Less actively involved.

Rely on others to decide what is important to be learned and done.

Accept the information being presented at face value.

Expect what they are doing will be useful in the long-run.

Work in an authority-oriented environment.

Feedback obtained from tests or rote memory drills.

YOUNG ADULTS/ADULTS

Uses a facilitator who arranges activities as a moderator or coach.

Share teaching with the group members and facilitator.

May have past experience upon which to draw—may have fixed viewpoints.

May have significant ability to serve as a knowledgeable resource to the facilitator and group members.

Focus on changing behavior.

Expect high participation.

Decide for themselves what is important to be covered in the session.

Need to validate the information based on their beliefs and experiences.

Expect what they are doing to be immediately useful.

Function best in a collaborative environment.

Feedback obtained from interaction with peers.

EXPLAIN: Young adults and adults learn very differently than children. These learners want to know what the material will accomplish for them and to be involved in the process. As one author describes it, effective facilitators as teachers are learner-centered catalysts.

C. Some Techniques That Employ Learning Theory

TECHNIQUES THAT EMPLOY IDEAS ON YOUNG ADULT/ ADULT LEARNING

1. At the beginning ask "What do you want to learn here?" and review questions at the end of class.
2. Establish ground rules for learning and get students to buy into them.
3. Distribute materials in advance as well as discussion questions.
4. Provide for plenty of opportunity to ask questions and discuss materials.
5. Put students into small discussion groups to enhance discussion.
6. Use polling and networking to promote discussion.
7. Use a good video.
8. Have students role play, conduct debates (with you or with each other), or make presentations.

3. WHAT IS FACILITATION?

FACILITATION

Leading a group or team of people through the process of learning new materials, solving a problem, making a decision, redefining goals, or restating expectations and responsibilities.

4. TECHNIQUES FOR EFFECTIVE FACILITATION.

A. Establishing A Comfortable Learning Environment.

Establish a Comfortable Learning Environment.

1. Establish and uphold ground rules.
2. Learn and call all students by their names (use name tags or name plates on their desks).
3. Show interest in all who participate (by nodding, smiling, supportive words ["good," "interesting," etc.]).
4. Listen for content and feelings (feelings are often the most informative and revealing).
5. Look for nonverbal cues (such as folded arms, daydreaming, etc.)
6. Use humor as appropriate (the self-deprecating kind often works best).
7. Maintain eye contact with class.
8. Where a student contribution seems irrelevant, choose what you want to hear (that is, "turn a sow's ear into a silk purse") by interpretation ("What I hear you saying here is.....")
9. Compliment students by referring back to what they said earlier.
10. Always be kind no matter what the provocation; that is, treat all students tactfully and courteously.
11. Link materials used in class to real world experiences as manifested in newspapers, magazines, or in students' work world.

DEVELOPING PARTICIPATION

1. Keep your own air time under 40%.
2. Use open-ended questions, preferably that are prepared in advanced. Three types of questions:
 - A. Convergent: requires analysis using materials or definitions used in homework.
 - B. Divergent: requires a new interpretation of events or institutions.
 - C. Evaluative: seeks to have students make normative choices.NOTE: see attached sheet for examples of these type of questions.
3. After asking a question, count to 10 before saying anything more (people need time to think through your question. In addition, people are often embarrassed by silences and will participate to deal with their embarrassment.). Where students do not understand your question or do not respond, rephrase it, but only after the 10-second pause mentioned above.
4. Use polling; that is, ask students to show their preferences either by raising their hands or in a written form. Once students have been polled, call on students who responded on each side of the question.
5. To involve the quiet types, ask everyone to comment on the question by starting with one student and then going through all the rest.
6. Use teacher role plays ("Well, what if I were the CEO in this case, what would you tell me to do?") or student role plays ("You're the President here; what would you tell your team to do?")
7. Give verbal reinforcement by use of supportive words ("yes," "I see," "good point").
8. Provide nonverbal reinforcement through eye contact, body language (maintain open, comfortable stance -- do not fold your arms), and smiling.
9. Use networking; that is, for example, ask students to discuss an idea or concept with a neighbor for 45 seconds and then report out on their discussions.
- 10 Put students into teams or work groups for the period, for several periods, or for the duration of the course.
11. Use lots of examples.
12. Ask one student to serve as a scribe who will summarize discussion at selected points.
13. Write what students say in summarized form on the blackboard (we all like others to recognize our contributions).
14. Pit student idea against student idea and then let others students join in the discussion ("Now I heard Amy say ... and John say What do the rest of you think?").
15. Serve as a devil's advocate by taking a position that is clearly contrary to what most of the students think on a topic.
16. Constitute student panels that will provide input to the class on some issue and lead discussion.

MANAGING OVER PARTICIPATION

1. Establish a ground rule that all should have the opportunity to participate and refer to it as needed.
2. Where someone is over participating, ask that student closed-ended questions.
3. Ask the over-participator for a link to the topic.
4. Ask the over-participator to serve as a silent recorder who will summarize the discussion at selected points ("John, you clearly know a lot about this topic. I do want others to have a chance to ask questions and get involved with this material. Therefore, would you serve as a silent recorder who will summarize what we are learning here at selected points? Thank you.")
5. Reflect back to the over-participating student what you have heard, and then move on to someone else.
6. Ask another student for their opinion on the topic.
7. Summarize discussion and move on to the next topic.

DEALING WITH AGGRESSIVE OR CHALLENGING STUDENT BEHAVIORS

1. Maintain a relaxed, open posture, a positive tone, and eye contact.
2. Remain non-defensive; do not apologize for the material or the activities, but be attentive to student concerns.
3. Clarify what you are hearing and acknowledge what you have heard by summarizing.
4. Use a problem solving approach ("You say this approach does not meet your needs; well then, what can I do to fix that problem?").
5. Let the class deal with unruly or inconsiderate students.
6. Seek to meet with dissatisfied students at the break or after class.
7. Always allow students to save face (other students will carefully watch your behavior and be more hesitant if you treat a student with lack of consideration).
8. Describe your reaction to inappropriate behavior.
9. Suggest alternatives if a student is dissatisfied.
10. Rather than criticize, use terms such as "more of" or "less of" ("I know that you are dissatisfied with this exercise, but I would like to see a bit more effort here to involve yourself for the benefit of others").
11. Seek clarification from the student if you do not understand the source of the dissatisfaction.
12. Take notes to capture feedback from students (use of the blackboard is a good technique).
13. When challenged or when you don't know the answer, defer to the class to respond ("Well, what do the rest of you think about that idea?").

5. SOME PERSPECTIVES ON FACILITATORS AS TEACHERS.

A. TWO PARADIGMS: LEARNING AND TEACHING:

LEARNING PARADIGM; FACULTY AS:	TEACHING PARADIGM; FACULTY AS:
Designers Leaders Empowerers Cooperators Mentors Navigators Teamers Coaches on the Side	Deliverers Lecturers Evaluators Critics Masters Know-It-Alls Loners Sages on the Stage

How would you describe your instructional approach -- as one who uses the learning or teaching paradigm?

Which is more effective with which types of students and in what types of courses?

B. EFFECTIVE FACILITATION AS TEACHING = E⁷
(KNOWN ELSEWHERE AS “EARL’S ‘Es’ ”)

- ENERGY in developing new ideas, new courses and revising syllabuses:
 - good facilitators as teachers invest enormous amounts of energy in what they do;
 - indeed, good facilitators as teachers work harder than those who lead others;
- ENTHUSIASM for the subject at all times;
 - if facilitators as teachers are not enthusiastic, how can they ask their students to be?
- EMPATHY for the students and the hard task they face in learning;
 - good facilitators as teachers always err on the side of their students;
- ENGAGED or always actively involved with students both in and out of class;
- EXPERTISE in their fields;
- EXCELLENCE and good organization in preparation and delivery;
- EXPERIMENTATION with new ideas and new techniques of facilitation as teaching;

C. WHY FACILITATORS AS TEACHERS WORK HARDER THAN LEADERS

In teaching leaders to facilitate, I concluded that facilitating as teaching is harder than leading, because:

- Facilitators as teachers cannot delegate.
- Facilitators as teachers must constantly assess, judge, and assist students in their development. One never stops "grading."
- Class preparation never ends.
- There is an endless search for new ideas and imaginative ways to present them.
- Facilitators as teachers are "on " whenever students are present.

So, facilitators as teachers must:

1. Always attend to students, but
2. Support and seek support from colleagues and family, and
3. Protect themselves from burnout through recreation, exercise, and time apart from others in contemplation.

6. STILL MORE QUESTIONS.

1. Are my propositions correct about adult learners?
2. Have you tried any of these techniques and have they worked?
3. What other techniques have you used to facilitate discussion and participation?
4. What new techniques have you learned today that you might apply to your own classes?

ARE YOU UP TO FUNCTIONING IN THE CLOUD?

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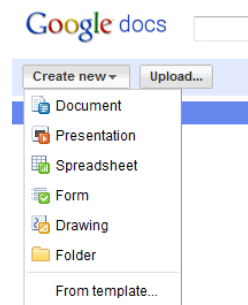
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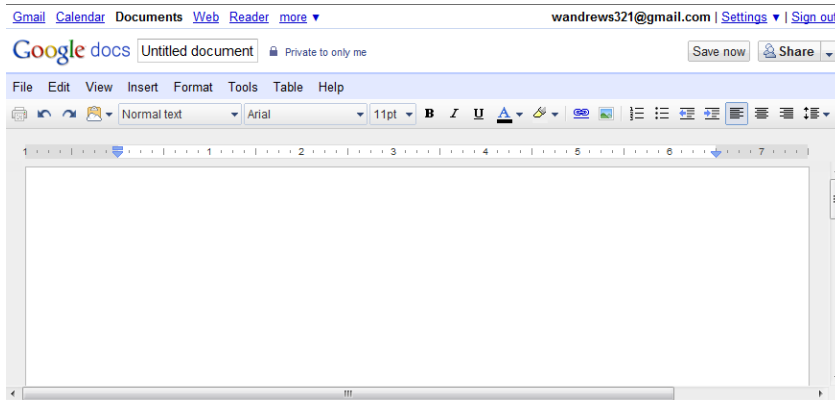
Abstract

Google Docs and Office 2010 Web Apps are the two main competitors for users wanting to use software suites over the WEB. This workshop will explore some of the products and issues involved with using the “Cloud” to create documents, file storage, backup and collaboration. Discussion will focus on the variety of advantages and disadvantages to using online office suites, along with advantages and disadvantages of following the “Cloud” Web trend for file storage and automatic backups of files. The goal will be to help participants decide whether one of these products would be a good choice for their computing needs.

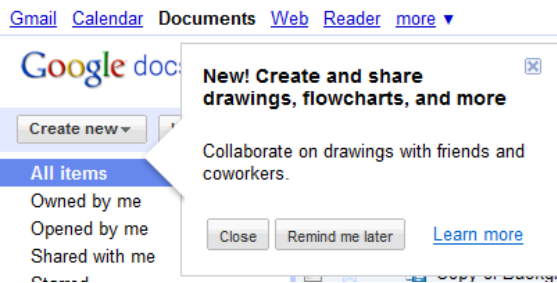
Online Office Suites

Google introduced Google Docs in 2007. At that time, online creation of documents and file storage was really new. Google has continued to offer more features and now also have Google Apps that are used by businesses and universities. Collaboration and access almost anywhere are strong points of Google Docs.



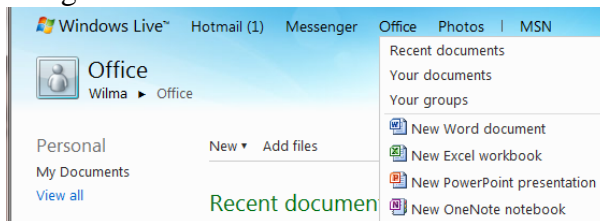


Updates and new Features are continually being introduced without requiring any downloading.

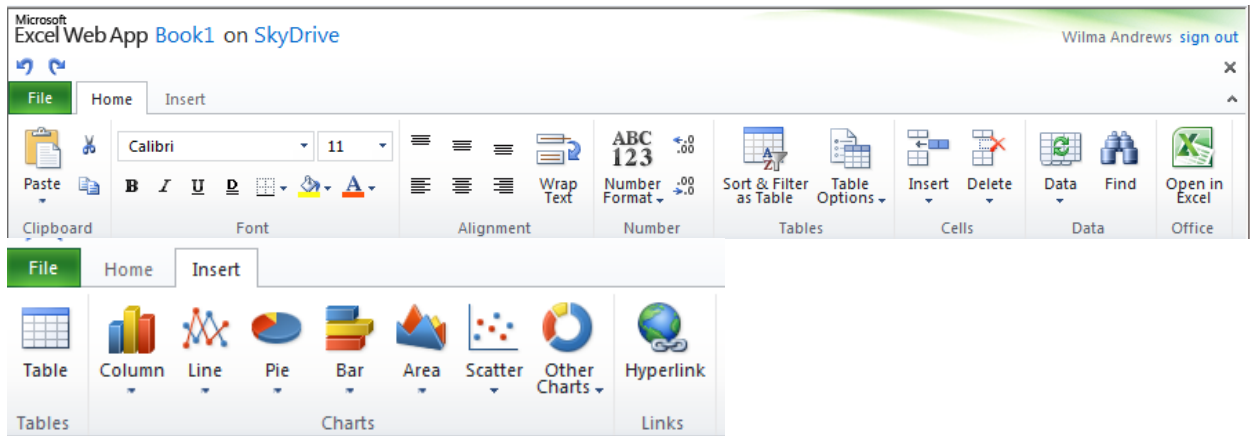
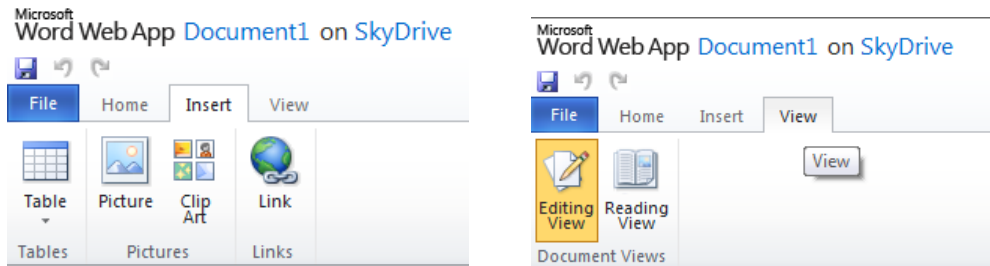
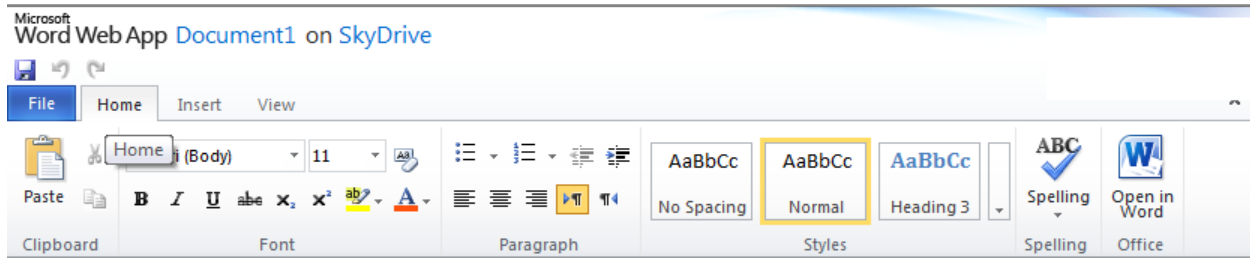


Office Web Apps is Microsoft's counter to Google Docs. Windows Live houses the online services for the Apps.

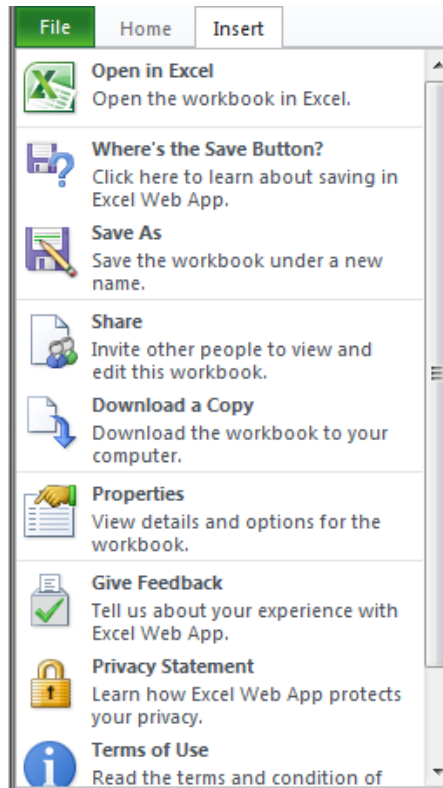
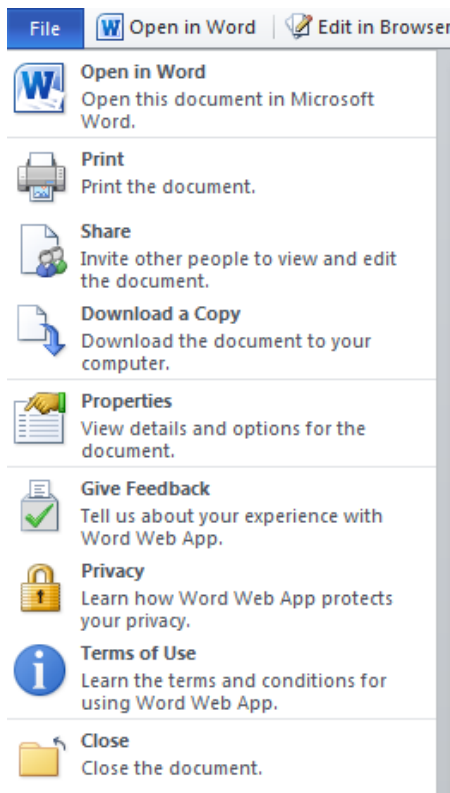
One advantage to using Office Web Apps for Microsoft Office users is the familiar user interface. For better professional looking documents it may be a better choice than Google Docs especially considering the ability to open them in the full Office software on a PC. But currently Google Docs offers some features that Office Web Apps does not.



The Web Apps use a simplified Ribbon User Interface as illustrated here for Word and Excel.



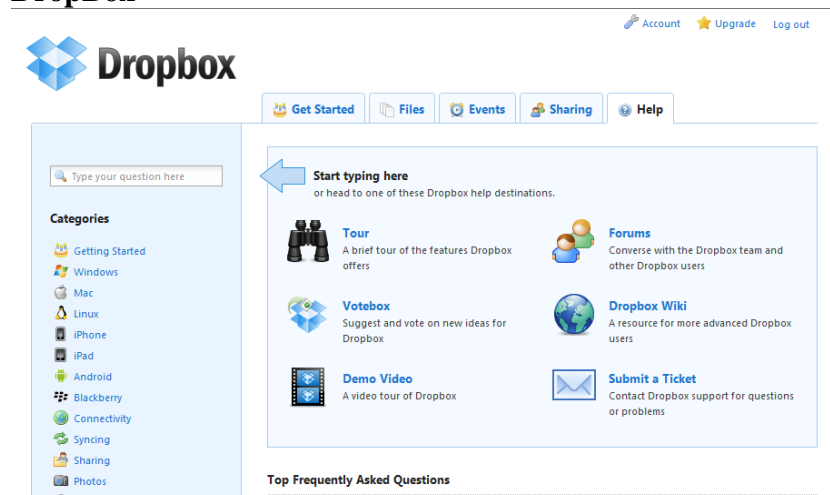
The options at File vary by application.



Cloud Storage Options

Microsoft and Google both offer cloud storage of files. The amount of storage varies. There are other free products some of which feature automatic backups, sharing features, or just storage. DropBox is an example of one that does storage, backup and sharing. Additional options will be discussed in the session.

DropBox



DECISION SUPPORT SYSTEM FOR RELIABILITY ASSESSMENT

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ABSTRACT

Assessing reliability of a survey instrument is an important part of a data oriented project. The purpose of the paper is to explain the design and implementation of the Decision Support System to assess how reliable a given survey instrument is to be used in the research. The primary objective in the construction of DSS is to have a quick and easy access to the status of an instrument for making decisions regarding the items in the instrument by considering the reliability aspect. The system is standalone, user friendly, and does not need specific technical knowledge of software to use. We have also achieved a high degree of automation for user convenience and efficiency. The system can provide useful information on various reliability coefficients for the survey instrument based on the different conceptual models for reliability.

INTRODUCTION

In quantitative research, it is required that the survey instrument measures what it is supposed to measure and that it does in a consistent manner. The items in a survey instrument need to have consistency of measurement. This consistency is referred as reliability in quantitative research. Inconsistency of items in a survey can lead to unreliable results. So, high degree of reliability of instrument is required to make quality research-decisions. Reliability is also considered as a measure of reproducibility of a survey instrument. Reproducibility is the variation of outcomes of an experiment carried out in conditions varying within a typical range. It describes the random error of the survey instrument. So we can say that reliability is a measure of precision. Reliability of a survey instrument can be assessed by four different ways:

1. **Internal Consistency Reliability:** It is a measure of reliability of different survey items intended to measure the same characteristic. It is based on the correlation among the items of the survey instrument. The smaller this variability (or stronger the correlation), the greater the internal consistency reliability of the survey instrument.
2. **Parallel-Forms Reliability:** It is estimated based on the two equivalent survey instruments of the scale constructed in the same way. It is based on the correlation coefficient between the responses obtained in two surveys.
3. **Test-Retest Reliability:** It is estimated by using the same survey instruments on the same (or similar) sample at different times or locations, assuming there is no substantial change in the scale being measured between two administrations. It is based on the correlation between such two or more sets of responses to the survey. The amount of time passed between survey administrations

is critical, because the longer the time interval, the lower the correlation and so the lower the reliability.

4. **Inter-rater Reliability:** It is estimated based on the correlation between the response from the same subjects to the items in a survey that is administered by two or more raters/interviewers. To get a higher inter-rater reliability, the raters should be randomly assigned to the subjects.

Reliability is estimated from the responses to the survey items, so quality of data is important in achieving higher reliability coefficient for the survey instrument. Data used for estimating reliability is required to be coded numerically and it can be dichotomous, ordinal, or interval. Observations should be independent, and errors should be uncorrelated between items. Each pair of items should have a bivariate normal distribution. Scales should be additive, so that each item is linearly related to the total score. More number of questions and clarity of the questions in a survey are some of the factors that can improve reliability of a survey.

In this paper, the researchers would like to explain the design and implementation of “ReliabilityDSS”, the Decision Support System that we developed to assess reliability of the survey instrument. It is based on different conceptual models as explained below. This system helps the user to make the decision on selection of items in the survey instrument to develop a more reliable survey instrument. The ReliabilityDSS provides item analysis that can help researchers to understand the potential effect of each item on the reliability of the instrument. A researcher can make a wise decision on each item based on this information. This menu-driven and user friendly system is a self-contained standalone system [1][12][16][19][23][28][30] [33][36].

CONCEPTUAL MODELS

The conceptual models of reliability that were used to construct ReliabilityDSS, the decision support system to assess reliability of a survey instrument are:

Alpha (Cronbach) Model: This is a model of internal consistency, based on the average inter-item correlation. The alpha reliability of the variable is derived by assuming each item represents a retest of a single item. For example, if there are ten items, it's as if the ten scores are the retest scores for one item. But the reliability is calculated in such a way that it represents the reliability of the *mean* of the items, not the reliability of any single item. Alpha reliability should be regarded as a measure of internal consistency of the mean of the items at the time of administration of the questionnaire. It is not test-retest reliability. For dichotomous data, alpha coefficient is equivalent to the Kuder-Richardson 20 (KR20) coefficient.

Split-half Model: This model splits the survey items into two parts and examines the correlation between the parts. It computes correlation between forms, Guttman split-half reliability, Spearman-Brown reliability (equal and unequal length), and coefficient alpha for each half. It is used to measure the internal consistency reliability.

Guttman Model: This model computes Guttman's lower bounds for true reliability.

Parallel Model: This model assumes that all items have equal variances and equal error variances across replications.

Strict Parallel Model: This model makes the assumptions of the parallel model and also assumes equal means across items.

Parallel and Strictly Parallel Model: This model computes test for goodness-of-fit of model, estimates of error variance, common variance, and true variance, estimated common inter-item correlation, estimated reliability, and unbiased estimate of reliability [9][10][12][15][17][24].

DECISION SUPPORT SYTSEMS

There is no agreement on the definition of Decision Support Systems. So, we are going to use the practical definition of DSS. A DSS is an interactive, flexible and adaptable computer based system that uses data, knowledge, and reasoning to aid management of a specific problem.

The DSS has generally the following components:

1. User Interface Module – Software system responsible for user communications.
2. Model Module – Software system that uses a conceptual model to make analytical computations.
3. Data Base Module – Software system to manage internal and external databases used for computations to make decisions.
4. Knowledge Base Module – Software system that manages problem specific knowledge [1][2][3][13][20][21][32][35].

ReliabilityDSS MODEL

In the context of the ReliabilityDSS, knowledge of conceptual models of reliability is the knowledge base and these models are static in nature. So, in this case, the knowledge base is the model base and the ReliabilityDSS is a model based system. The system model used for construction of ReliabilityDSS is essentially composed of the following major components: User Interface Module, Model Base Module. The architecture to construct the ReliabilityDSS from this system model is described as follows:

The System Architecture to implement the ReliabilityDSS consists of System Processor, Model Base, User Interface, and Output Interface. User input interface contains the mouse and keyboard events to collect information from the users regarding the data. The output interface is responsible for saving the information generated by the processing module in the appropriate format and displaying that information for user to make the decisions. System Processor consists of processors: User Input Processor, Model Base Processor, and Output Processor. Each of these processors is responsible for processing specific tasks, such as accessing and processing the user inputs, and making necessary computations based on the models to draw conclusions regarding requested analysis on data. The architecture for the ReliabilityDSS is shown in Figure 1 [12][21][25][26][27][32][35].

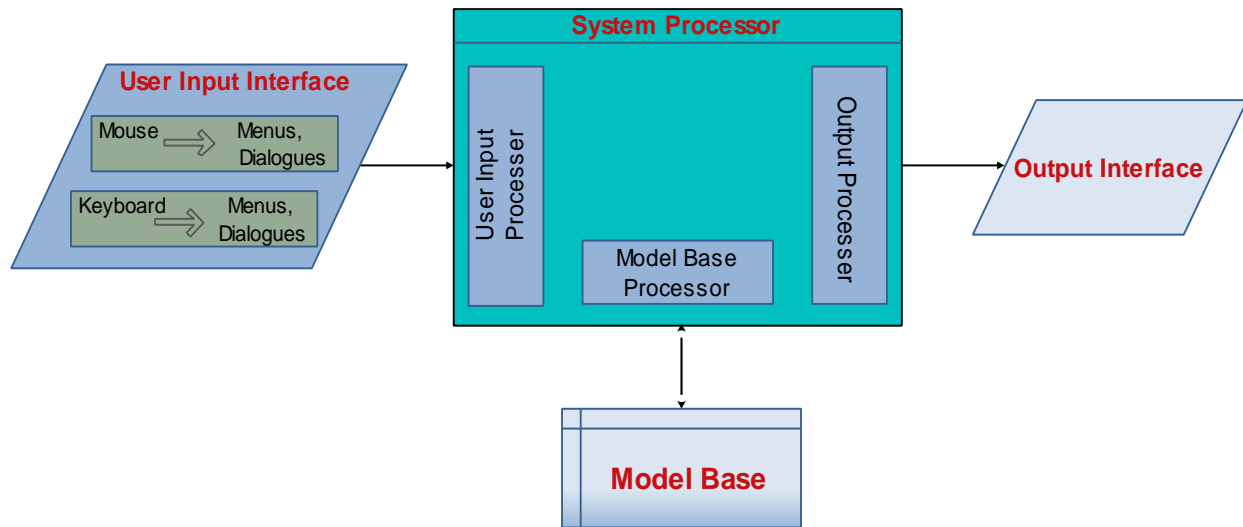


Figure 1. Architecture of ReliabilityDSS

IMPLEMENTATION

A prototype of ReliabilityDSS, the decision support system to assess reliability of a survey instrument is implemented based on the above architecture in the Microsoft Windows environment. The menu driven graphic user input interface is implemented using the current GUI techniques. User dialogues are implemented to collect user input, as needed.

The System Processor is implemented as several sub processors that are responsible for specific tasks such as processing user inputs, processing data, performing necessary computations using knowledge base, and generating the requested results by implementing the conceptual models on the data.

Several types of descriptive and inferential statistics are generated in this process. Descriptive statistics on items such as individual item means and standard deviations as well as correlation coefficients are generated. Item-total statistics is generated including the scale mean, scale variance, and corrected item-total correlation, and the Cronbach Alpha coefficient of reliability for each case in which an individual item is deleted. This will be useful in estimating the relative contribution of each item to the overall instrument. The Cronbach Alpha and Standard Alpha reliability coefficients are computed to estimate the reliability of the whole instrument. In addition, Spearman-Brown and Guttman coefficients with some descriptive statistics can be generated for the split-half model in addition to the alpha coefficient for each part, when the split-half option is selected. If the total number of items in the sample is odd, the system will divide the sample into two parts with the first part having one more item. The system saves all the generated results in the output file.

The output interface is implemented by the display procedures using data aware controls. It displays the results of the reliability analysis and the results will be saved in a text file that can be opened by any text editor or word processor [4][5] [6] [7][8][9][11][14] [18][19][20][22][27][29][31][34].

TESTING

The system was tested on more than one data set. To cover all the options of reliability assessment generated by this system, we selected a data file with at least two subjects and at least four items in the survey instrument. A data set used for testing in the following example contains 249 subjects providing responses to 14 items in the instrument. A part of the data file looks as shown in figure 2.

```
1 2 4 4 4 5 4 2 2 1 5 2 2 2
1 1 1 2 1 1 3 1 1 1 3 2 1 2
2 4 4 2 3 5 4 3 3 2 4 4 3 3
1 1 1 1 1 1 3 1 1 1 1 1 1 1
2 2 2 2 2 3 2 2 2 2 2 2 2 2
2 5 2 2 2 3 2 2 1 2 1 1 1 1
1 4 1 5 2 2 3 2 1 1 3 2 1 1
1 5 1 2 2 4 3 3 2 2 2 2 2 2
1 2 2 2 1 1 3 1 1 1 1 2 1 1
2 2 2 2 2 2 2 2 2 1 2 1 2 2
1 1 1 3 2 2 3 1 1 1 1 3 1 1
1 1 2 2 1 1 3 2 1 1 2 1 1 1
```

Figure 2. Data File

This DSS system collects the necessary input from user through menus and user dialogues. The output file that contains results of the reliability analysis on the data file after running the reliability system on the test data is shown in Figure 3. The output generated by the system consists of several sections of statistics such as correlation matrix, item statistics, item-total statistics, and various reliability coefficients as described in the “Implementation” section. The system was run in two sessions, one requesting the analysis for the complete instrument, and the second one requesting the analysis for the split-half option.

Session I

RESULTS ON RELIABILITY ANALYSIS

CORRELATION MATRIX

ITEMS	1	2	3	4	5	6	7	8	9
1	1.0000								
2	0.5423	1.0000							
3	0.2713	0.4387	1.0000						
4	0.2668	0.3690	0.3843	1.0000					
5	0.3288	0.3030	0.5372	0.5504	1.0000				
6	0.1683	0.4491	0.6137	0.3129	0.5515	1.0000			
7	0.1221	0.1625	0.2527	0.1596	0.1552	0.2919	1.0000		
8	0.4727	0.6309	0.5169	0.3331	0.5140	0.6345	0.3135	1.0000	
9	0.4860	0.4259	0.2717	0.3964	0.4736	0.2803	0.2950	0.5175	1.0000
10	0.4564	0.5082	0.4098	0.3848	0.4030	0.3384	0.0183	0.5619	0.3620
11	0.3275	0.4475	0.5351	0.4940	0.5318	0.5704	0.5506	0.5547	0.5174
12	0.4269	0.3905	0.2505	0.2802	0.4464	0.3520	0.3483	0.5064	0.5181
13	0.4582	0.4477	0.4594	0.4773	0.6530	0.4339	0.1261	0.6154	0.5285
14	0.4531	0.5119	0.4897	0.2922	0.4133	0.4533	0.4105	0.6389	0.5458

Figure 3. Results Generated by the System

ITEMS	10	11	12	13	14
10	1.0000				
11	0.2897	1.0000			
12	0.3753	0.5240	1.0000		
13	0.5563	0.4057	0.5665	1.0000	
14	0.3519	0.6504	0.5941	0.5188	1.0000

ITEM STATISTICS

TOTAL NUMBER OF ITEMS = 14
TOTAL NUMBER OF CASES = 249

NO	MEAN	STD DEV
1	1.9076	1.0177
2	2.7430	1.2207
3	2.2932	1.1352
4	3.1044	1.2236
5	2.2209	1.0373
6	2.3896	1.2939
7	3.2088	1.0647
8	2.4739	1.1641
9	2.2169	1.1004
10	1.7068	0.8790
11	2.7671	1.3145
12	2.1888	1.0242
13	2.2369	1.0415
14	2.4659	1.1604

ITEM MEANS	MEAN	MINIMUM	MAXIMUM	RANGE	MAX/MIN	VARIANCE
	2.4231	1.7068	3.2088	1.5020	1.8800	0.1751

ITEM VARIANCES	MEAN	MINIMUM	MAXIMUM	RANGE	MAX/MIN	VARIANCE
	1.2673	0.7726	1.7278	0.9552	2.2364	0.0717

ITEM-TOTAL STATISTICS

STATISTICS FOR SCALE	MEAN	VARIANCE	STD DEV	NO OF VARIABLES
	33.9237	115.2240	10.7342	14

NO	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM-TOTAL CORRELATION	ALPHA IF ITEM DELETED
1	32.0161	103.3143	0.5256	0.9082
2	31.1807	98.4310	0.6318	0.9045

Figure 3-(cont'd). Results Generated by the System

3	31.6305	99.9275	0.6172	0.9050
4	30.8193	100.9068	0.5215	0.9089
5	31.7028	100.3388	0.6645	0.9034
6	31.5341	97.7257	0.6186	0.9052
7	30.7149	106.1321	0.3628	0.9138
8	31.4498	96.1114	0.7780	0.8986
9	31.7068	100.1678	0.6286	0.9045
10	32.2169	104.4286	0.5579	0.9073
11	31.1566	94.6972	0.7348	0.9001
12	31.7349	101.3005	0.6245	0.9048
13	31.6867	99.5709	0.7009	0.9021
14	31.4578	97.3783	0.7204	0.9009

RELIABILITY COEFFICIENTS OF A SURVEY INSTRUMENT

CRONBACH ALPHA COEFFICIENT = 0.9111
STANDARDIZED ALPHA = 0.9113

Session II

RESULTS ON RELIABILITY ANALYSIS

STATISTICS FOR SPLIT-HALF METHODS

NUMBER OF ITEMS IN PART1 = 7
NUMBER OF ITEMS IN PART2 = 7
MEAN FOR PART 1 = 17.8675
MEAN FOR PART 2 = 16.0562
VARIANCE FOR PART 1 = 28.3412
VARIANCE FOR PART 2 = 34.5775
CORRELATION BETWEEN THE TWO PARTS = 0.8354
EQUAL LENGTH SPEARMAN-BROWN COEFFICIENT = 0.9103
UNEQUAL LENGTH SPEARMAN-BROWN COEFFICIENT = 0.9103
GUTTMAN SPLIT HALF COEFFICIENT = 0.9079
ALPHA COEFFICIENT FOR PART1 = 0.7881
ALPHA COEFFICIENT FOR PART2 = 0.8783

Figure 3-(cont'd). Results Generated by the System

CONCLUSION

In experimental or applied research projects, quality of data used for performing research is crucial for producing reliable results. The collection of data depends on a survey instrument that researchers use. Hence, the reliability of the results depends on the reliability of the survey instrument used. So the reliability of an instrument becomes an important issue. The purpose of our decision support system is to assess the reliability of the instrument before it can be used. The reliability system produces several descriptive and inferential statistical results which can be used to make decisions related to the reliability of the instrument. The decisions made by using the results of the system can give opportunity to correct and enhance the quality of the instrument before its final use in the research. We hope, in this respect, that this system would be an important and useful tool for researchers in developing reliable survey instruments for their research.

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INTELLIGENT SYSTEM HUMAN-MACHINE INTERFACES

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The leading edge of management information system programming has turned to the emerging paradigm of artificial intelligence as the panacea for intricate, complicated business problems. Yet many times the solutions proposed for these problems appear to be almost trivial applications of artificial intelligence, or the application process leads to inelegant solutions for lower order problems. Expert systems and decision support systems may require specific contextual situations for application or, in the case of expert systems, may require the user to be a subject matter expert in order to be able to realistically communicate with the system.

The alternative to this misapplication of artificial intelligence is to reconsider the function of the interface or boundary between the human and the machine. Much more elegant solutions evolve when each is assigned roles that are in concert with their capabilities. Ultimately, the goal of such a reevaluation should be the development of hybrid, human-machine processes. Such processes, designated here as intelligent systems, are possible within the limits of artificial intelligence techniques and

technologies available today. This paper is a conceptual exploration meant to provide a conceptual framework for developing further research into the management of decision making throughout the various levels of an organization.

Intelligent Systems

Intelligent systems are different from other forms of artificial intelligence. Intelligent systems are hybrid in terms of their technical base. An intelligent system with a hybrid base might, for example, employ a knowledge base or expert system as a discretionary front end to a technical or instrumental base decision support system. Intelligent systems are always interactive. Human and machine serve together in a complementary way. The system architecture for an intelligent system considers the capabilities and limitations of each (Sutherland, 1989).

Efficacy of design requires that both are doing their best within the context of the environment. Design determines specifically what the human and what the machine will do. Both the human and the machine must be adapted to the processing schema. The human is required in order to inject judgment modification, to intervene in cases of ambiguity, and to decide the level of precision required in a given problem set or activity. The machine must make the human aware of out-of-range data and of suspected anomalies within the data set. Thus an intelligent system is able to compensate for weaknesses in the human.

Uncertainty and Decision-Making

Simply put, whenever a choice is presented, a decision-making opportunity exists and with every decision opportunity, a certain amount of risk is a given. The most often cited decision making models: the Rational model, Bounded rationality model and the Garbage can model all wrestle with the idea of risk and uncertainty (Harrison, 1981; Ackoff, 1981; Cohen, March and Olsen, 1972). Generally, when decisions are routine, clear, and unambiguous we refer to those as programmed decisions which will have an established decision rule upon which to base the decision; conversely, when decisions are complex, ambiguous and unique, decisions require a more creative approach, or non-programmed decisions (Nelson, Quick, 2009). Whether the decision is programmed or

non-programmed and the appropriate level within levels of management, is at the heart of the intelligent system-human interface.

Understanding Selections in Situations Involving Uncertainty

Decision Support Systems generally involve situations with some degree of certainty. More interestingly, Intelligent Systems can be used to predict a utility index of choices in these uncertain situations. Whether or not such a utility index is ordinal or cardinal is of some debate. But proceeding here assumes that such a utility index possesses some cardinal properties.

Situations that involve some degree of certainty are often not realistic because they require the decision maker to make decisions and take actions that are prescriptive of particular determinate consequences which are knowable in advance. All Widgets of the same model and produced at the same location do not always have the same characteristics. As a result of random variances in the production process, some substandard Widgets are sometimes produced and even sold. If **A** represents a situation where a purchase results in owning a perfectly good Widget, **B** results in no purchase of a Widget, and **C** results in the purchase of a substandard Widget; the choices are limited when **A** is preferred to **B** and **B** is preferred to **C**. The choices are: (1) make no purchase and own no Widget – this is a choice with certain outcome (a probability of 1); (2) purchase a Widget with a chance that it will be a satisfactory one (alternative **A**) or that it will be an unsatisfactory one, alternative **C**. The decision maker may then prefer not to buy a Widget with a certain outcome or may chose to purchase with uncertainty as to the outcome. Or the decision maker may be indifferent as to the outcome. If the probability of **C** is very high, the decision maker may not make any purchase which results in certainty. Likewise if the probability of **A** is very high, the preference would be to purchase the Widget. As a convention the triplet (**P**, **A**, **B**) is used to denote such a choice with outcome **A** with a probability $0 < P, 1$ and with outcome **B** with the probability $(1-P)$.

The decision maker must prefer **A** to **B**, **B** to **A**, or is indifferent to **A** or **B**. However it is transitive. If **A** is preferred to **B** and **B** is preferred to **C**, then the decision maker prefers **A** to **C**. Also there is some value of **P** where $0 < P, 1$ where the decision

maker is indifferent between outcomes **B** and the choice (**P**, **A**, **C**). However, if the decision maker is indifferent between **A** and **B** and **C** is any other outcome then the decisions are independent of each other. If one alternative selection, **S**₁, offers outcomes **A** and **C** with associated probabilities of **P** and (1-**P**) and another alternative selection, **S**₂, has the same probabilities, **P** and (1-**P**), then the decision maker is indifferent as to the outcomes **A** and **C**. Likewise another alternative selection, **S**₂, with outcome **B** and **C** with the same probabilities **P** and (1-**P**) will result in the decision maker being indifferent to the outcome.

If the decision maker **A** to **B**, **S**₁ = (**P**₁, **A**, **B**) and **S**₂ = (**P**₂, **A**, **B**), then the decision maker will prefer **S**₂ to **S**₁, if and only if **S**₂ > **S**₁.

If, for some reason, the choices or selections are compared where **S**₁ = (**P**, **A**, **B**) and **S**₂ = (**P**₂, **S**₃, **S**₄) where **S**₃ = (**P**₃, **A**, **B**) and **S**₄ = (**P**, **A**, **B**), **S**₂ is equivalent to **S**₁, if **P**₁ = **P**₂**P**₃ + (1-**P**₂) **P**₄. With **S**₂ known, the probability of obtaining **A** through **S**₃ is **P**₂**P**₃. Also, the probability of obtaining **S**₄ is (1 - **P**₂) and the probability of obtaining **A** through **S**₄ (1-**P**₂) **P**₄. So the probability of obtaining **A** through **S**₂ is the sum of the two probabilities.

The decision maker evaluates the selection only in terms of the probability of obtaining a favorable result and utility, not how many times they are exposed to the choice mechanism.

Intelligent systems pit these alternatives against each other and help us to understand decision maker behavior. If the decision maker obtains satisfaction from risk activities even where **P** could conceivably consist of **P** = 0 or **P** = 1. Such a decision maker is indifferent between outcome **B** with certainty and the uncertain prospect of **A** and **C**. This decision maker is not a good candidate for Intelligent Systems applications. However, if the decision maker prefers certainty, behavior is governed by the continuity and compounded selection possibilities discussed above.

The Domain of Intelligent Systems

An early requirement in the development of intelligent systems is to identify the relative domain for the human and for the machine. These relative domains serve as a point of departure for the identification of points of interface in hybrid systems.

Determining these points of interface facilitates the identification of the resources required to embody the system.

For example, there is no need to burden or arouse the human with routine operational decisions or data that could be effectively handled, with little or no human interaction, by a machine. But a machine should not be assigned the function of decision making for a lower level decision when the decision must be made without communications to higher authority (Manner, 1989 and Lawrence, 1967).

Modalities

An intelligent system may operate in modalities that emphasize human, machine, and human-machine relationships.

Conditional Modalities

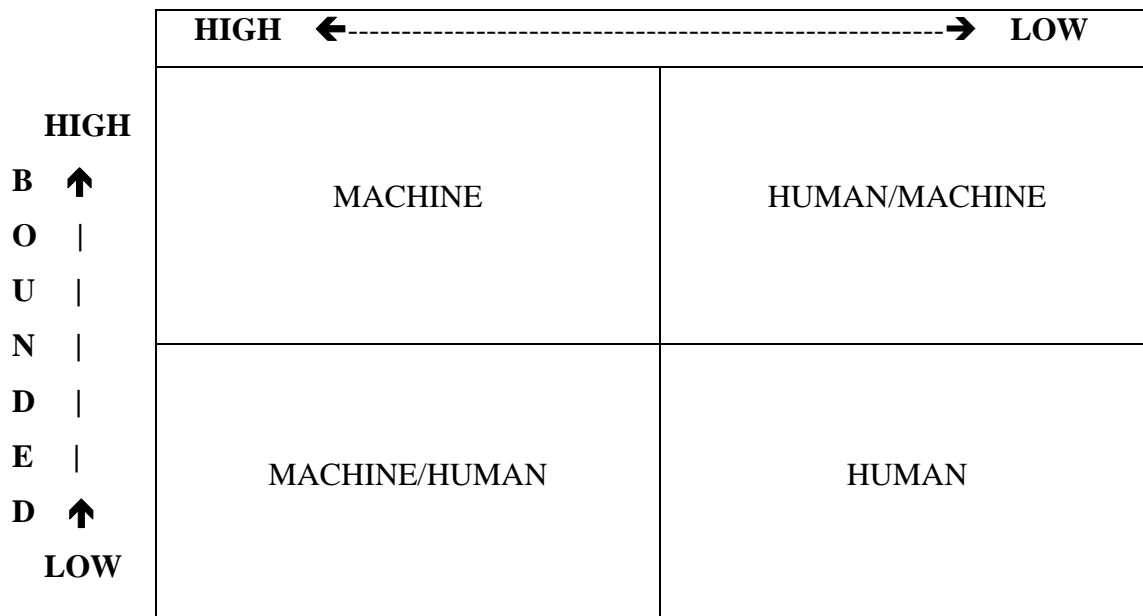
Hybrid, human machine intelligent systems may result in four different states of operating condition modalities which are shown in Figure 1.

The first to be discussed is the human only mode. The human only mode is required whenever the events found in the environment are too unstructured for current artificial intelligence technology. System design should only cast the machine in a support function role by providing information requested by the human. The second mode is the machine only mode. Here, the problem is very structured, well defined and bounded. No input is needed nor is possibly desirable for the system to perform or function. Finally, there exists a human machine/machine human mode (Mathews, 1991). Two different sequences are required to indicate two different priorities of operation.

First is the machine human mode. In this mode, the external event-driven problem is well structured but it is not well defined or bounded. There exists a possibility that the machine will encounter a situation that is outside the planned limits of the system. In such cases, the machine would be allowed to continue to operate using false, incorrect or incomplete data. The human would retain the ability and authority to override the process.

FIGURE 1 OPERATING CONDITION MODALITIES

STRUCTURED



In the human machine mode, the human is primary. Here artificial intelligence systems are relegated to supporting and monitoring roles. It would be the machine's responsibility, in this mode of operation, to notify the human if a potential error in judgment is detected. However, the machine would not have the capability to modify the operating state based upon a perceived judgment error without the concurrence of the human. This was the case in modes dominated by the machine. Machine dominant modalities infer that a machine-selected system course of action may not be overridden by the human without considerable effort (Mathews, 1993).

Statistical Modalities

In order to discuss the theoretical acceptable limits of intelligent systems, a hypothetical goal of a typical entity that could apply this hybrid approach might be stated as:

To provide timely and accurate information about the current situation, to make recommendations as to the proper response to emergent events, and to provide automated responses to situations where human reaction times are not adequate or where human intervention is not necessary.

An intelligent system must be able to support the above stated goal in two distinct operational states. The first state of operation is an “at risk” state. In the state, the system must assure that most hostile business actions by a competitor are detected and acted upon before harm or damage results. The second state of operation is a “not at risk” state. In this state the system must ensure that no unwarranted hostile or aggressive action is taken.

These two states of operation can then be summarized by the two hypothesis tests:

AT RISK:	H ₀ : We are under hostile actions or threat.
	H ₁ : We are not under hostile actions or therats.
NOT AT RISK	H ₀ : We are not under hostile actions or threats.
	H ₁ : We are under actions or threats.

Statistically specific definitions and symbols apply to these tests. The first concept is called a Type I error which implies rejecting the null hypothesis when it is true. The second, called a Type II error, is accepting the null hypothesis when it is false. For the “not at risk” state of operation, the Type I error would result in the assumption of a defensive posture where none is required. Such a defensive posture could result in a threatening response to a non-threatening event. But permitting a Type II error would result in a hostile event coming to fruition because the condition state should have been redefined to require assuming a defensive posture. Currently, the human is required to establish a probability such that the chance of making a Type I error is very small. If the environment is declared to be threatening, then the operational mode shifts. Errors in such an environment are to be made to assure resultant safety of the system. The Type I error now becomes one of not taking action for a non-threatening event.

Clearly this is a two state system with diametrically opposed operating parameters. The actual decision then becomes one as to when to shift the mode of operation from not a risk to at risk. Additionally this decision, made at the highest levels of an organizational hierarchy, must be made in favor of the system. Accordingly, the system architecture must recognize these two states of operation and account situations characterized by a limited amount of time being available to correct a Type I error when the environment is considered to be “not at risk” (Andriole, 1986).

Organizations face a multi-dimensional set of events. Increased data gathering capabilities increase the human's awareness as to the scope of an organization's operations, yet the same human also faces conditions typified by stress, high levels of risk and the need for timely responses. No single human can hope to maintain detailed control of dynamic situations in the face of such complexity without decision aids. The human is not capable of meeting the challenge alone.

Expected Utility

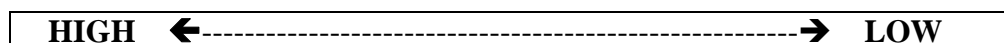
The expected utility (**EU**) under man-machine conditions for a two choice selection $\mathbf{S} = (\mathbf{P}, \mathbf{A}, \mathbf{B})$ is $\mathbf{E} [\mathbf{U} (\mathbf{S})] = \mathbf{P}\mathbf{U} (\mathbf{A}) + (1 - \mathbf{P}) \mathbf{U} (\mathbf{B})$. Consider a man, machine selection where $\mathbf{S}_1 = (\mathbf{P}_1, \mathbf{A}_1, \mathbf{A}_2)$ and $\mathbf{S}_2 = (\mathbf{P}_2, \mathbf{A}_3, \mathbf{A}_4)$. If \mathbf{S}_1 is preferred to \mathbf{S}_2 then the expected utility $\mathbf{E} [\mathbf{U} (\mathbf{S}_1)] > \mathbf{E} [\mathbf{U} (\mathbf{S}_2)]$. Simply put, in uncertain situations, decision makers can analyze the man-machine selections in terms of a maximized utility function.

Applications

Intelligent systems may be applied to business situations in four distinct roles as shown in Figure 2: as a director, as a consultant, as a facilitator and as a corroborator (Mathews, 1991).

The first role, the *director*, substitutes the machine dominant intelligent system for local judgment. The emphasis is upon the ability of the machine to do planning and decision making rather than the ability to support decision making. The machine may allow for some degree of human expertise. But normally the directive role proceeds whenever the human is unavailable as a consequence of expert scarcity, inadvisable as a result of a hostile environment, or as a result of a need for numerical or manipulative intricacy best done by the machine.

FIGURE 2
LEGITIMATE BUSINESS APPLICATIONS FOR INTELLIGENT SYSTEMS



**HUMAN
INVOLV
EMENT**

HIGH
↑
I
N
|
M V
A O
C L
H V
I E
N M
E E
N
T
↑
LOW

DIRECTOR	CONSULTANT
FACILITATOR	CORROBORATOR

The second role, *consultant* places the intelligent system in a role of advisory significance. As such, the machine gives high quality advice to use by man to complement man's own perceptions, hypotheses or judgments. The man uses the machine to either reinforce or refute his conclusions.

The third role, *facilitator*, uses the machine in supporting and monitoring roles. The machine would notify the human if a potential error in judgment is detected. Only the human has the capability to modify the operating state of the system.

The fourth role, *corroborator*, uses the machine to control the quality of the human's choices. Mid-level managers, for example, might be required to use the machine to corroborate the quality of decisions before committing to some response. The human cannot proceed until the machine has validated his conclusions. The role provides a critical contribution towards coupling an instrument base (algorithms, probabilistic decision aids and judgmental decision aids) with a knowledge base or expert system.

The object in all four of these applications is essentially the same: to put a vast world inside a small box so that people can explore it any way they chose. Techniques

such as those suggested by this paper show how to proceed towards the goal of integrating the human and machine.

Summary

This paper has presented a unique perspective of the interface between human and machine in an environment that encompasses a complex and intricate mix of data analysis and communications. The troublesome features of risk and errors in judgment have the potential of leading to decompositions of dynamic systems that place too much emphasis on the human in the loop. Unanticipated events and ambiguity evade the best of plans when an event exceeds the limits of rule based artificial intelligence systems. The ultimate resolution of many of these problems lies within potential design limits of hybrid systems that incorporate modalities that account for the human-machine interface exchange. This paper has provided, in a conceptual manner, the basis for selections based on maximization of an expected utility function. Optimization of selections on a basis other than hunches, gut reactions, feelings, etc., add a new dimension to artificial intelligence through the use of intelligent systems. Further development is required to fully realize the potential of these intelligent systems. Knowledge based intelligent systems thus have the potential to serve as a mechanism to guard against casual, catch as catch can, ad hoc event analysis. As a new technology, an intelligent system may lend itself to abuse, to charlatanry and to Luddite attacks. A great deal of work must be done before practical applications are realized. The possibilities, however, are virtually endless. The simple roles identified here point towards a different way of viewing the role of the human and the machine in large systems that may exist in volatile, complex environments.

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