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## **Incorporating Quality Management Tools into the Business Law Course**

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### **ABSTRACT**

Today's business student needs to practice what the professors preach and this paper describes how to incorporate quality management tools into the business law course. Even in the typical lecture and case method format, business law teachers can incorporate these tools into the coursework. While it does take a bit more time and creativity, the students benefit from these tools by seeing quality management tools in operation. More importantly, using these tools in the business law context allows students to see the critical connection between quality management practices and risk management.

### **INCORPORATING QUALITY MANAGEMENT TOOLS INTO THE BUSINESS LAW COURSE**

The typical business law class is taught in the lecture format using the Langdellian case method in which students are expected to derive legal rules from reading select cases by learning the legal reasoning. This method is used in part because business law classes often are too large for discussion formats and in part because most business law teachers are also lawyers educated in this method (Gross, 2005; Rakoff & Minnow, 2007). Most business law classes, and certainly business law textbooks, are theory-based and focus on substantive legal rules compartmentalized into the traditional law school subject areas, such as torts, contracts, and property. Appellate cases are presented to students as the primary method for learning these legal rules. The case briefs always provide the procedural history, but unfortunately, the substantive context of each case is missing since the case is edited to focus on a particular legal rule. Theoretically, if a student understands the legal reasoning applied to the particular facts of a case, they will learn the legal rule and be able to apply the rule to real-world situations.

There is nothing inherently wrong in the use of case studies and the methodology is useful for developing critical thinking and engaging in active learning (Tellis, 1997). However, even law schools are questioning the use of the traditional legal case study method common in business law courses (Robbins, 2009; Stuckey, 2009). The problem with the traditional legal case method for business students is that the business world is not compartmentalized into clear legal issues, disputes do not arise spontaneously and with a clear statement of facts, and most cases generally do not go to trial, much less reach the appellate level. Since most business students take only one semester of law and the typical case method focuses on a specific legal rule, students rarely have the opportunity to understand how a situation might develop over several years before reaching the appellate level, how the dispute failed to resolve before trial, the management lesson for minimizing risk, or the political and legal policies underpinning cases.

Business law teachers need a better way to guide their students to an understanding of why a dispute arises and how to resolve the dispute before it reaches the point of a lawsuit. In other words, business law teachers need to connect the legal lesson to the management lesson.

This paper will offer some suggestions on how to incorporate quality management tools into the business law course. The first section describes how to use quality management tools, such as root cause analysis, to help explain how a management event, such as a slip and fall, develops into a dispute and eventually into a lawsuit. The second section describes how to use quality management tools, such as concept mapping, to analyze the context of a case in the larger scheme of corporate activity. The third section describes how to use quality management tools for business law class projects. The paper concludes by summarizing the relevant tools and offering some resources for business law teachers.

## **USING QUALITY MANAGEMENT TOOLS TO ANALYZE A LAWSUIT**

Quality management is based on a number of principles including customer focus, a process approach, involving people, a factual approach to decision making, and continual improvement (ISO 9000:2008). Operating under quality management principles generally improves the bottom line (Freiesleben, 2004) and reputation (Freiesleben, 2006). Failure to meet quality management principles risks lawsuits or administrative agency enforcement actions (Cable, 2007; White and Pomponi, 2003). Therefore, a business law class is a wonderful venue for demonstrating that quality management practices can reduce risk in the form of business disputes and litigation. Even in a large class, quality management practices can be demonstrated and incorporated into the coursework. Several methods are relatively easy to incorporate into a business law class, particularly Root Cause Analysis.

### **Root Cause Analysis**

Root Cause Analysis is a tool for determining the origin of an event, such as a person's illness, an automobile rollover, or a manufacturing plant explosion. The tool identifies not only the what and how of an event, but why it happened (Rooney & Vanden Heuvel, 2004). The root cause of a lawsuit generally is ignored in business law textbooks. Rather, business law textbooks tend to provide some rudimentary facts that led a plaintiff to sue a defendant. While this may suffice for law students learning legal principles and how to advocate for their clients, business students need to become managers skilled in preventing disputes. Business students better understand how they can minimize risk of disputes by knowing the origin(s) of management events and how the event plus a company's response creates the context for a lawsuit.

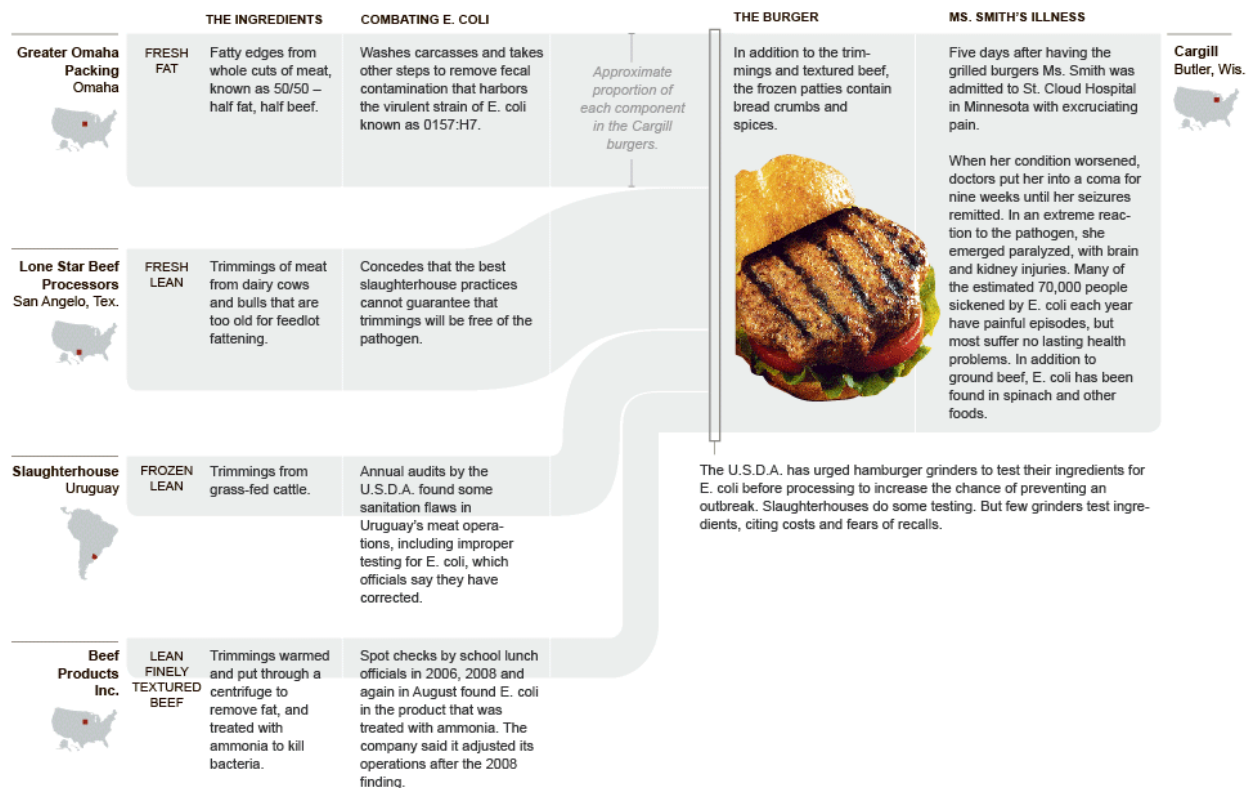
In the courtroom, the root cause is an essential element of a case and is the point of origin for liability. For example, if a product liability lawsuit is filed after a product design or manufacturing defect causes injury, then lawyers hire experts to determine the *root cause* of the product malfunction in order to prove (or disprove) the legal element of causation (Gooden, 2001). In addition, identifying the root cause may exclude some defendants or identify other liable parties. Since root cause analysis will inevitably be used in expert testimony regarding causation, students should learn this in their business law class.

## Case Example

In the fall of 2007, dance instructor Stephanie Smith became severely ill with bloody diarrhea and stomach cramps. Stephanie, only 22 years old, went to the hospital when her kidneys shut down and seizures knocked her unconscious; she fell into a coma for nine weeks. Her illness, which left her paralyzed from the waist down, was caused by a virulent strain of E. coli known as O157:H7 and was traced to a hamburger she ate. In response to Ms. Smith's story and 15 other outbreaks of E. coli, the New York Times traced the story of the hamburger she had eaten and published an exposé on the meat industry.

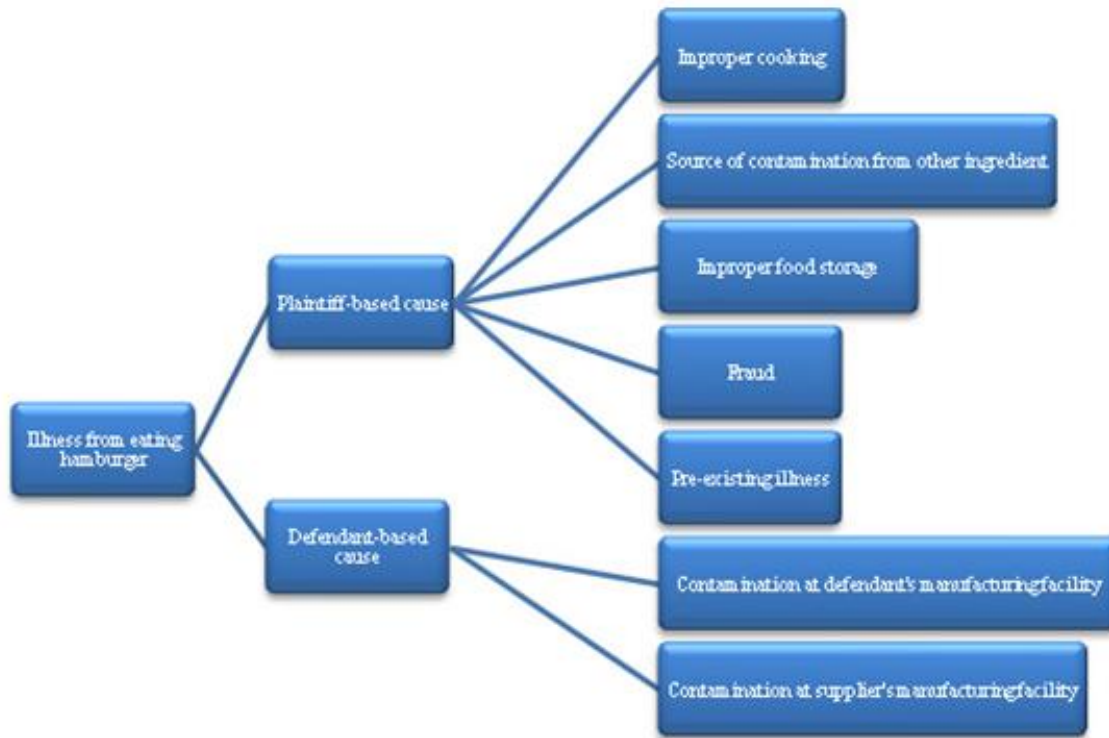
The New York Times exposé demonstrated that the hamburger patty, from a box labeled "American Chef's Selection Angus Beef Patties," was manufactured by Cargill Meat Solutions and contained "an amalgam of various grades of meat from different parts of cows and even from different slaughterhouses" (Moss, M., 2009). Ms. Smith hired well-known attorney Bill Marler to sue Cargill. The New York Times article provided an excellent graphic (Figure A) depicting the origins of the contamination, which will undoubtedly prove useful in the litigation against Cargill Meat Solutions and other defendants.

**FIGURE A**  
**New York Times Graphic: Anatomy of a Hamburger**



Root Cause Analysis may be used to show students how a defendant might approach a claim of food poisoning (Figure B). Students who *see* how a plaintiff and defendant might view a fact differently can better understand why the element of causation is so important, why experts are required to prove a case, and why settlement of a dispute may not be the immediate response by the parties involved.

**FIGURE B**  
**Root Cause Analysis of Cargill Food Poisoning Claim**



This type of case analysis stimulates learning in two important ways. First, the subjects of the case -- hamburger production, a severely injured person, a multi-national company -- provoke an emotional response in the students and improves memory (Ramsden, 1992; Viadero, 1996; Wiemer, 2002). Second, the "story" of the case engages the student and allows them to create their own links to their own experience (Miley, 2009).

Using Root Cause Analysis, a teacher has the opportunity to further challenge students to think how the problem event and resulting lawsuit might have been prevented; this is active learning and requires critical thinking. How might this management event and resulting lawsuit be prevented from occurring again? Would better training resolve the problem or is it a policy matter? Is the underlying issue one that should be resolved by more regulation or was this a company specific problem? Root Cause Analysis and follow-up questions not only allow the student to learn the legal rules related to negligence and strict liability, but connect the legal lesson to the management lesson.

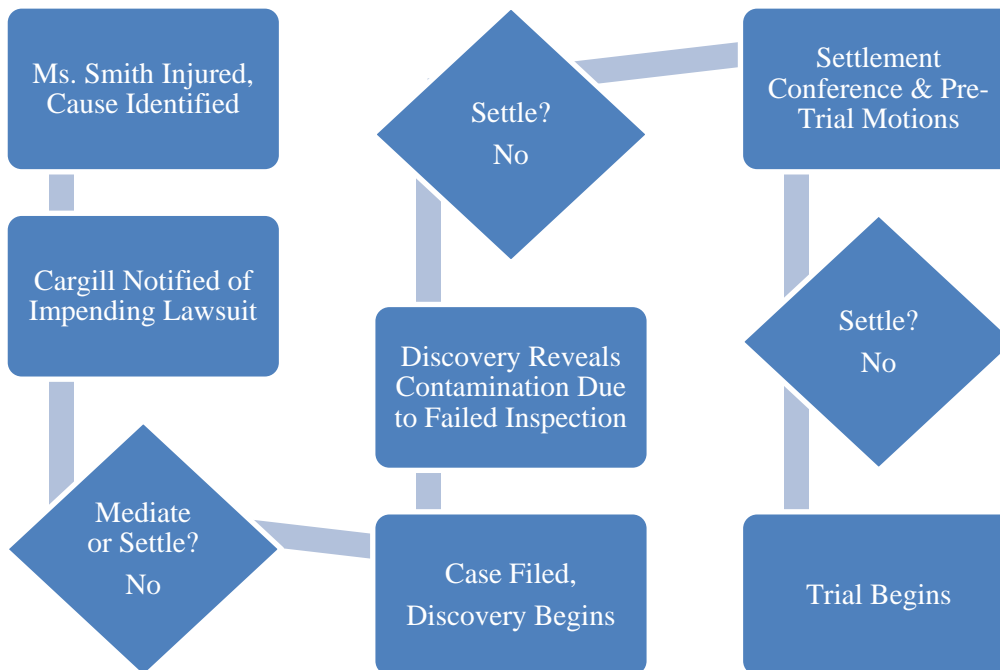
## USING QUALITY MANAGEMENT TOOLS TO ANALYZE THE CONTEXT OF A LAWSUIT

A management event, such as a person's illness, may be caused by a dangerous strain of bacteria, but not all illnesses result in a lawsuit. One set of questions relate to why an illness developed into a lawsuit:

- Why did Stephanie Smith file suit?
- Why didn't the parties settle?
- Was there a better resolution than trial and verdict?

In this case, a process analysis tool is useful. Figure C provides an example of a simple flowchart for the Cargill case. A student can see the various points at which the case could have been resolved prior to trial. More events and decision points can be added for greater detail and discussion by students.

**FIGURE C**  
**Flowchart of Process From Injury to Trial**



In the case of Cargill, the questions that relate to the context of the Cargill case are numerous and include:

- What laws regulate the meat industry?
- What government agency was responsible for regulating this food process?
- Was there an impact on the company's employees, shareholders, and overall reputation?

The themes or issues underlying these questions may be depicted visually by using an idea creation tool such as an affinity diagram or concept map to better understand the context of a lawsuit. Affinity diagrams are useful when confronted with complexity and/or apparent chaos. Figure D provides an example of an affinity diagram for the Cargill case.

**FIGURE D**  
**Affinity Diagram for the Cargill Food Poisoning Case**

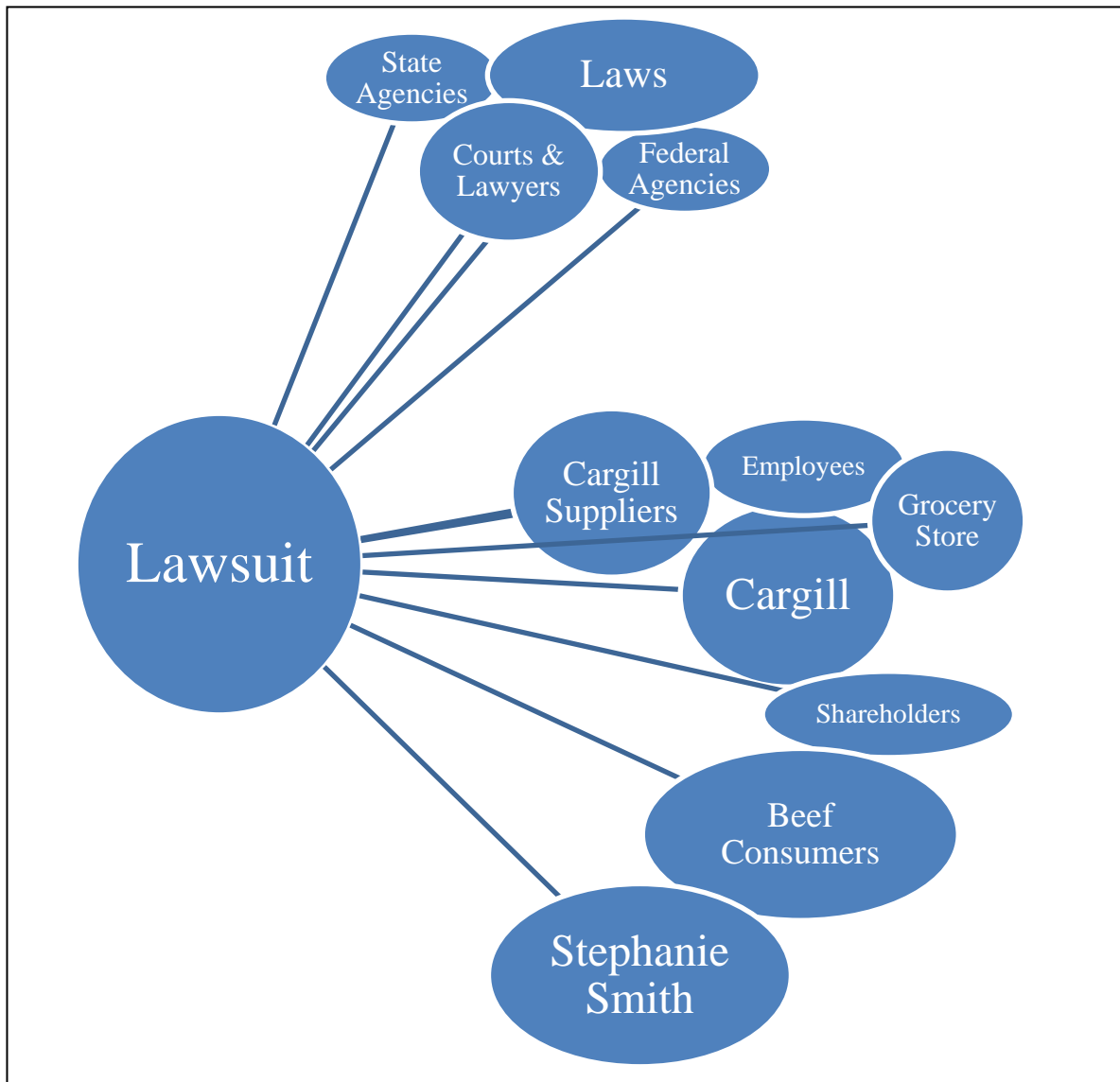


Figure D depicts for the student that the situation is more complex than a person becoming ill after eating an infected hamburger; other people and institutions are involved, each with a special interest in the situation. These other people and institutions might promote or hinder the prosecution of a lawsuit and these entities certainly are affected by the outcome. A different affinity diagram might depict the specific parties in the lawsuit, including plaintiffs, defendants,

lawyers, and courts. Yet another might depict the relevant laws applicable to the meat industry. Both teacher and student have ample opportunity to explore the full context of a lawsuit and understand the linkages between law and policy, company and stakeholders, risk and risk prevention.

### **USING QUALITY MANAGEMENT TOOLS FOR PROJECTS AND COURSE PROGRESS**

Many business law courses require students to engage in projects, either individually or in teams. Most universities don't offer their students the software for Microsoft Project®, but tried and true project management tools help students (a) keep on track, and (b) practice quality management skills. One easily applied project management tool is the Gantt chart. Figure E depicts a very simple example used for a business law class project completed by the tenth week of the semester.

**FIGURE E  
Gantt Chart for Business Law Class Project**

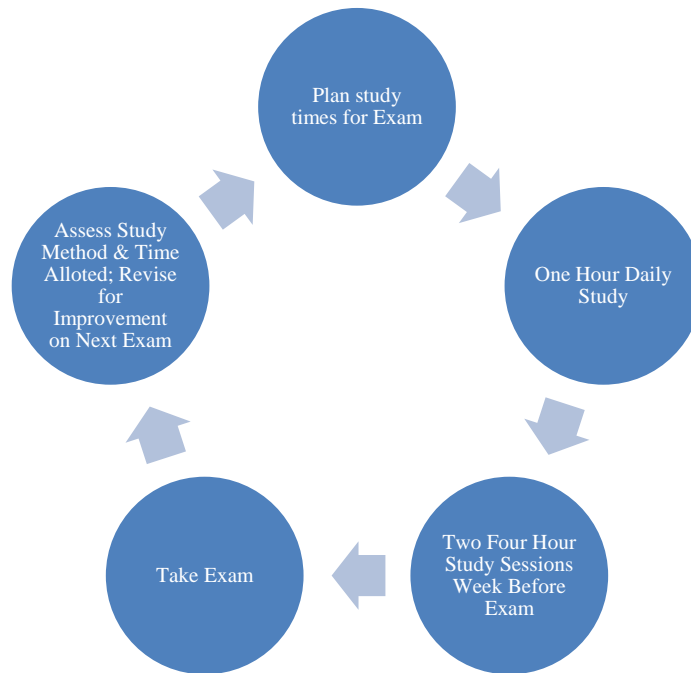
ACTIVITY / WEEK	1	2	3	4	5	6	7	8	9	10
Form Teams										
Develop Company Concept										
Submit First Progress Report										
Draft Organizational Documents										
Submit Second Progress Report										
Draft Two Contracts										
Submit Third Progress Report										
Develop Response to Lawsuit										
Present to Class										

A variety of Gantt charts may be developed according to the specific needs of the project (Tague, 2004). The charts may include columns for the amount of time the task is expected to take, the amount of time actually taken, monetary or personnel resources required for the task, or earned value of the project per milestone. Microsoft Excel® provides an easy tool for creating Gantt charts, but other software and templates are available for use (e.g., KIDASA Software, Inc.).

Another quality management tool for course progress or projects is the Plan-Do-Check-Act Cycle used to monitor continuous improvement. While this tool is most beneficial for a teacher for assurance of learning and course development, students can learn to use this tool to study for tests and improve during the course, particularly if the teacher offers bonus points for improvement during the semester. Figure F depicts a simple Cycle for exam preparation. While showing this to students certainly won't ensure that students are prepared for each exam, it does make them think about the process of exam preparation. This Cycle may be connected to a Gantt chart to provide visual evidence of exam preparation.



**FIGURE F**  
**Plan-Do-Check-Act Cycle for Exam Preparation**



### **CONCLUSION**

The quality management tools described above are visual methods for engaging students in critical thinking about the cause, development, and context of a legal case, as well as methods for tracking their progress on a particular project or in a particular course. The traditional case study method used in business law courses should not necessarily be set aside, but should be augmented by quality tools that enhance student learning and retention.

The quality tools presented in this paper are, by no means, the only tools available for use in a business law class and most students learn a variety of these tools in their first operations management course. Many more tools are carefully explained in Tague's book, *The Quality Toolbox*, and in various print and online publications of the American Society for Quality. Lynn and Kalfayan (2006) describe the process of barbecue using quality tools and the complexity of the process seems to tempt fate and a tortious event. One can think of countless lawsuits and product recalls that would be impressive if quality tools were applied to explain the context of and how the cases developed: the Exxon Valdez, the Bhopal disaster (Union Carbide and Dow Chemical), Enron, AIG, Vioxx, silicone gel breast implants, lead-coated toys and contaminated peanut butter, to name only a few.

The most important reason to use quality management tools to enhance business law classes is to engage students in active learning (Stuckey, 2009; Wiemer, 2002) and deep learning (Houghton,

2004). The expected result is that students will link new concepts to principles and experiences already known, move new concepts to long-term retention, and apply the knowledge to solving problems in new situations.

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## Return on Investment for Supply Chains Partners

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# Return on Investment for Supply Chains Partners

## Abstract

Supply chains are evolving from tightly coupled vertically integrated configurations to tightly coupled collaborative configurations. In the first configuration, one company owned or directly controlled the major portions of the supply chain and could allocate costs and benefits through transfer pricing mechanisms. In the second configuration, companies depend on each other to achieve a smooth flow of goods and services from their origin to the ultimate consumer. The second configuration could be termed virtual integration.

It is probably safe to say that most supply chains are somewhere in between the extremes described above. But where are they? How are companies dealing with the problem of moving from the security of vertical integration to the uncertainty of tightly coupled globally dispersed independent operations? This paper describes a third configuration – a loosely coupled supply chain composed of individual entities working together in often informal relationships.

## Introduction

One of the more difficult problems facing supply chain members is how to fairly divide responsibilities and proceeds from the supply chain operation. In the past, individual businesses could calculate the return on investment for its own operation. In this age of supply chains, where the success of individual companies is dependent on the success of the supply chain in which they operate, there is a need to share the common pain and gain.

To date, there is not a lot of evidence to indicate that companies, and supply chains, are working to share the net proceeds of their combined efforts. However, as supply chains mature, more companies will search for ways to do it. In order to share benefits and costs, supply chain members must develop an integrated supply chain. Much of what has to be done involves supply chain learning. Unless the supply chain partners share their knowledge and understand its implications, there is little likelihood they will agree on the positive proceeds from the supply chain and how to distribute them among the members.

In an attempt to “gain insight into supply chain competence and the factors that enhance its development,” Spekman, Spear and Kamauff (2002) posed the following requirements for supply chain learning:

- There must be trust between partners and they must be committed to the concept of SCM.
- Partners must share their combined knowledge and understand its portent.
- Relationships between partners must be co-mingled to enhance knowledge transfer.
- Decision-makers must be flexible, adaptive and ready to learn.
- The cultures must be trusting and open to facilitate learning.

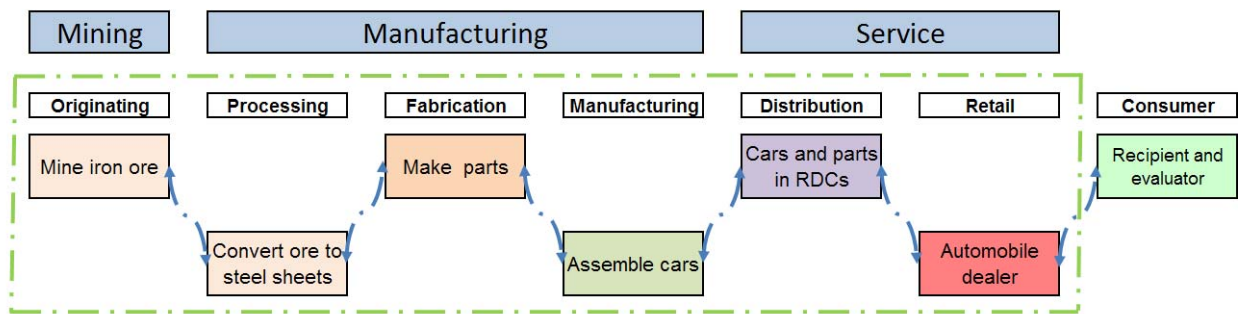
- Partners must believe in and support a win-win orientation.

Knowledge sharing is a necessary prelude to financial sharing.

### Supply Chain Configurations

Supply chains evolved from tightly coupled vertically integrated configurations to tightly coupled collaborative configurations. In the first configuration, one company owned or directly controlled the major portions of the supply chain and could allocate costs and benefits through transfer pricing mechanisms. In the second configuration, companies depended on each other to achieve a smooth flow of goods and services from their origin to the ultimate consumer. The second configuration could be termed virtual integration.

It is probably safe to say that most supply chains are somewhere in between the extremes described above. But where are they? How are companies dealing with the problem of moving from the security of vertical integration to the uncertainty of tightly coupled globally dispersed independent operations? This paper describes a third configuration – a loosely coupled supply chain composed of individual entities working together in often informal relationships. Figure 1 shows a supply chain that moves toward the ultimate consumer through loosely coupled links that work at varying levels of effectiveness and efficiency. It gets the job done, and the individual companies may be operating at high performance levels. The opportunities for improvement are in the inter-company links. While these improvements are real, they are difficult to evaluate. It is even more difficult to assign credit for the individual contributors.



**Figure 1. Loosely Coupled Supply Chain without Uniform Directional Focus**

The preceding discussion showed that integrated supply chains are complex and somewhat disjointed, making sharing of proceeds difficult. In the remainder of this paper, we describe some of the approaches used to bridge these difficulties.

We first describe programs developed in the past two decades that require close supply chain relationships. We then describe a process whereby supply chain members can attempt to determine the return on investment (ROI) in a supply chain. After that, we outline some possible ways in which the supply chain members can divide the net proceeds among themselves. We also discuss the role of the

prime mover company in a supply chain, because it is likely that a single company will exert the greatest influence and, as a leader, must take responsibilities that other participants need not assume. Inasmuch as supply chain relationships are dynamic and apt to change over time, we describe some ways in which these transition periods can be handled. We include four case studies to provide examples of approaches to the distribution of supply chain proceeds among its members. Finally, we suggest some possible areas of future research.

### **Programs Requiring Close Supply Chain Relationships**

Global competition is forcing companies to improve – or go out of business! Successful companies continue to search for some competitive advantage, whether it is in price, quality, flexibility or, more recently, in response times. Just as they strive to reduce costs and improve quality, companies are trying to reduce the time it takes to get an order from the supplier to the customer and to get new products to the market. It is no longer good enough to be low cost and high quality; you must be responsive and flexible, too.

Some programs have evolved over the past two decades to reduce the lead times demanded by customers, mostly retailers who have tipped the balance of power from the manufacturers to retailers, such as Wal-Mart, Home Depot and Kroger. While these programs have individual identities, they are gradually being absorbed under the umbrella of supply chain management.

#### ***Programs***

The programs described below were designed to reduce lead times from supplier to customer. The primary thrust was to remove the excess inventories from the supply chain so the needed inventory could flow smoothly and quickly. This faster flow provided other benefits such as reduced costs, improved quality and greater flexibility in responding to changes in volume and mix. Other programs, such as JIT, Lean, TQM and Six Sigma also helped to reduce excess inventories; however, their primary goals were to reduce cost and improve quality.

**Quick Response Systems (QRS).** In the early 1980s, a group of interested manufacturers and retailers, in the textile and apparel industries, hired Kurt Salmon Associates to recommend a program that would reduce the number of stockouts at the retailers by providing a closer matching of demand and supply. The program was to provide a way to reduce lead times for stock replenishment orders from manufacturer to retailer and reduce the lead times for introducing new products. There were a number of components to the program but the essential ingredients were willingness, and a capability, to communicate quickly actual demand data from the retailer to the supplier who could have time to prepare for orders from their downstream customers. Another goal was to reduce the bullwhip effect by placing orders on a more regular and predictable schedule.

The potential was high; how did it do? Alan Hunter (1995) reported, “In the 10 years since its formulation, quick response has made only limited progress despite its well-demonstrated benefits to the

apparel industry.” He listed the expected benefits as reductions in pipeline inventories; greater probability of garment designs and colors being acceptable to the consumer; ability to re-estimate stock keeping unit (SKU) demand at retail, and greater competitiveness for domestic producers facing increased levels of imports.

Some of the problems that have delayed the widespread adoption of QR include:

- Naivety – participants didn’t realize the magnitude of the task
- Difficulty in creating “partnerships;” the retailers got the benefits while the suppliers incurred the costs
- Structural issues, such as the staggering number of unique SKUs (1.2 to 1.4 million at a department store every four months); overwhelming effect of fashion – shelf lives are decreasing; and the make-up of the pipeline – retailers and textile companies dominate; apparel manufacturers are small
- Technical problems, including inadequate accuracy of bar codes, inadequate storage and manipulation of inventory and sales data; and lack of standards in information transmission (EDI)

The factors necessary for growth of Quick Response include the need for UPC/EAN compliance and standardization; the clarification and acceptance of the role of VANs; and the need to find a way to extend EDI to smaller manufacturers.

Kurt Salmon Associates (1997) expanded the scope of Quick Response programs to include product development and product sourcing, as well as product distribution. Despite its slow beginning, QRS programs provided a model for other industries to follow and for subsequent programs to build upon.

**Continuous Replenishment Programs (CRP).** Closely allied with QRS, CRP programs were designed to encourage automatic replenishment ordering so that the customers would automatically place an order when their inventory management system indicated a need for a reorder. (Lummus and Vokurka 1999).

**Efficient Consumer Response (ECR).** Encouraged by the positive results in the QRS programs, in 1992, several grocery executives formed a voluntary group, known as the Efficient Consumer Response Working Group, and commissioned a study by Kurt Salmon Associates “to identify opportunities for more efficient, improved practices in the grocery industry.” The consultants returned in early 1993 claiming that the industry could reduce inventory costs by 10 percent, or \$30 billion. (Frankel 2002). In addition to efficient replenishment, this group added the requirement of category management, consisting of efficient new product introduction, efficient store assortment, and efficient promotion. The program included collection of demand (sales) data with point-of-sales (POS) terminals, and feedback of this data to suppliers with electronic data interchange (EDI). Suppliers could then avail themselves of a variety of techniques, such as cross docking, to move the product more quickly to the customer.

**Vendor Managed Inventory (VMI).** Some retailers decided that, inasmuch as the suppliers had the consumer demand data, they (suppliers) could assume the responsibility of managing their (retailer) inventory. While the idea of suppliers managing a retailer’s inventory was not new – rack jobbers and service merchandisers did it in the health and beauty aids categories years before – it did have the added element of rapid feedback of demand information. One study reviews the information technology challenges, especially the effects of information delay and accuracy. (Angulo et al. 2004). Another study

concludes that, even for products with stable demand, a partial improvement of demand visibility can increase production and inventory control efficiency. (Smaros 2003).

**Sales and Operations Planning (S&OP).** This program has been around for at least 30 years and was originally intended to get marketing and production to collaborate on a production schedule within a company. S&OP represents a way to get companies to talk with one another and smooth the flow of goods along the supply chain. In a recent survey, it was identified as the No. 2 initiative of global companies, following strategic sourcing of direct materials. (Poirier and Quinn 2004).

**Collaborative Planning, Forecasting and Replenishment (CPFR).** In 1997, voluntary inter-industry commerce standards (VICS) created a sub-committee to develop CPFR as an industry standard. The following year, VICS issued the first document on CPFR: "VICS CPFR Guidelines", which has been constantly updated since then (see [www.cprf.org](http://www.cprf.org), VICS 2000). While QRS and ECR provided the flow of demand information from the retailer upstream to suppliers, it was the responsibility of the supplier to anticipate demand and the retailer (except in VMI) to actually do the ordering. CPFR attempted to eliminate uncertainty by advocating both the customer and the supplier collaborate to plan a joint demand forecast and replenishment schedule.

Barratt and Oliverira (2001) list several issues they believe were addressed for the first time with CPFR, including:

- the influence of promotions in the creation of the sales forecast (and its influence on inventory management policy);
- the influence of changing demand patterns in the creation of the sales forecast (and its influence on inventory management policy);
- the common practice of holding high inventory levels to guarantee product availability on the shelves;
- the lack of co-ordination between the store, the purchasing process and logistics planning for retailers;
- the lack of general synchronization (or co-ordination) in the manufacturer's functional departments (sales/commercial, distribution and production planning);
- the multiple forecasts developed within the same company (marketing, financing, purchasing, and logistics).

They also provide an excellent summary of benefits, barriers to implementation, and enablers of the CPFR process, and conclude that trust and good information technology must be present for success.

### ***Present Status***

How are companies doing in their quest to reduce response times? A simplistic answer is that the programs work but few companies are getting the full benefit of the programs because of incomplete implementations. There are three key components to any program of this type: technology, infrastructure and change management. The technology, primarily in the form of electronic data collection, with POS terminals, and data transmission, with EDI or the Internet, is good and getting better. The infrastructures – organization, systems, and functional relationships – are inconsistent among companies and industries, but improving. Managing change is a continuing problem, particularly in the area of company culture and



trust. How much do you trust? Which customers/suppliers do you trust? Almost every study finds trust is not only essential for success, but also often lacking in many programs.

Crum and Palmatier (2004) list the following reasons why demand collaboration programs have not realized their potential:

- The pace of adopting new ways of doing business is slow.
- Demand information supplied by customers is used in trading partners' own demand, supply, logistics, and corporate planning in an integrated manner.
- Demand management and supply management processes are not integrated, and sales and operations planning is not utilized to synchronize demand and supply.
- There is lack of trust among trading partners to share pertinent information and collaborate on decision making.
- Participants desire to partner but do not commit to executing the communicated plans.
- Some view demand collaboration as a technology solution and the current technology is too complex.

Most companies think of CPFR as a technology; however, it is the business process supported by the internal culture that makes CPFR successful. Computer Sciences Corp., in conjunction with Supply Chain Management Review, recently concluded its second annual Global Survey of Supply Chain Progress. Their findings suggest that some companies understand the advantage of leveraging the buy across a more strategic supply base, while others are content to pursue more limited, tactical improvements. Despite the progress needed in some areas, most companies pursuing the various supply chain initiatives are generally happy with the results. However, only 28% said that an awareness of the need to increase customer satisfaction ratings was a main factor in the success of their initiatives. (Poirier and Quinn 2004).

One seemingly simple problem is the need for consistency in product data identification and transmission. UCCnet, a nonprofit unit of the Uniform Code Council standards organization, established a global online registry that requires product data with as many as 151 attributes, or descriptors, about 40 of which are mandatory. One well-known company found that it was transmitting information by phone, E-mail, fax, CDs, EDI, PDFs, spreadsheets, Web sites, and printed price pages. The same survey found that the percentage of companies that felt they have the business processes in place to take full advantage of real-time information varied from 20% in the construction and engineering industry to slightly over 70% in the logistics and transportation industry, with the overall average of all industries around 45%. (Sullivan and Bacheldor 2004).

Another nagging question is the relative benefits between retailers and suppliers. Corsten and Kumar (2005) studied the question of "Do collaborative relationships with large retailers benefit suppliers?" They found that, while suppliers benefit in the economic sense and in capability learning, they believe suppliers bear more of the burden and receive less of the benefits they deserve.

Some activities are increasing the response times, most notably the offshore outsourcing movement. An Industry Week study (Vinas 2005) observes that the route to cheaper supplies from overseas sources may look like a clear path, but supplier lead times are elongating, a step back from the improvements wrought from years of lean implementations. "Some companies may find the payoff worth it. Others may

find themselves with cheaper raw materials and components, but fewer customers.” It just takes longer to get product from another country. The costs may be lower but the response times and uncertainty of supply are higher. Balancing the trade-offs, such as between supplier responsiveness and order stability, requires a great deal of skill. (Hutchison 2006).

### ***Future of Improvement Programs***

What does the future hold? No doubt, the pressure to clean out excess inventories in supply chains and gain a better matching of supply with demand will continue. Individual programs, such as those described above, are losing their focus, as they become a part of more general programs such as supply chain management and integrated demand-driven collaboration systems. A survey of over 60 retailers in the United States, Europe and Asia found that the persistent problem of out-of-stock to be their biggest inventory challenge. To combat this, “the best of these retailers are poised to move past spreadsheets and into SKU/store-level automated planning and replenishment systems as their tools of choice. Within the next 24 months, more than 80% of retailers surveyed will have implemented automated systems to support virtually all aspects of their planning, allocation, and replenishment operations.” (Rosenblum 2005). Another study suggests that retail exchanges, stemming from improved IT, may provide part of the answer. (Sparks and Wagner 2003).

Whatever the program, companies must integrate their communication systems and develop sufficient trust with one another to collaborate effectively and to gain the benefits of their efforts. If they do, they can hope to succeed. If they do not, they face an uncertain future.

The programs described above contributed positively to the supply chains used by the participating companies. Individual companies were able to reduce inventories, shorten stock replenishment times, and provide improved service levels to customers. In most cases, participating companies were able to see tangible benefits from the programs. However, these programs were not designed to allocate costs and benefits among the supply chain participants.

### **Benefits of Supply Chain Programs**

How do companies quantify the return on investment for an entire supply chain? It is unlikely that it can be done by starting with the total income and investment of a company, as often reported in a company’s annual report. This is a macro number that is the result of numerous variables, many well beyond the scope of the workings of the supply chain. Rather, we believe that the evaluation of the ROI for a supply chain requires a project analysis approach where the effects of individual, incremental actions are considered. In this approach, we will consider both tangible and intangible benefits and costs.

### ***Direct benefits***

It follows that the term “tangible” implies that dollar values are readily available. (We will use dollars for our discussion; however, any unit of currency applies.) Unfortunately, this is not the case. Even where there are tangible benefits, it may be difficult to assign a dollar value, even indirectly.

#### ***Reduced inventory***

One of the most obvious benefits from supply chains is reduced inventory. This is a prime objective of a supply chain, so it follows there should be a reduction in the total inventory over time. Although none of the approaches are easy, it should be possible to establish the total inventory related to the supply chain operation at some point in time. Periodically, then, the total inventory in the supply chain can be reported to see how much the total inventory has decreased. By using a carrying cost percentage (one that is accepted by other supply chain members), it is possible to calculate a dollar savings.

#### ***Reduced cycle times***

Another objective is to determine how much the supply chain reduces the total cycle times for moving the product along the supply chain to the consumer. This time can be expressed in days or weeks and, when compared to a base period, a cycle time reduction can be calculated. Converting a reduction to cycle time into dollar savings requires someone to assign a value to the reduction in response time. Does the reduction in cycle time result in increased sales or reduced costs? Are there other factors to consider? Does this calculation duplicate some of the savings for reduced inventory?

#### ***Improved customer service***

Improved customer service also has some tangible features, such as increased percentage of on-time deliveries, reduced stockouts, and reduced errors in invoicing. As with cycle times, customer service performance indicators are tangible but may also be difficult to convert to dollar increase in sales.

#### ***Improved quality***

Improved quality means fewer defects, reduced inspections, reduced repairs or reworks, and fewer ruined products downstream in the supply chain. However, the costs of quality have been elusive and few accounting systems are set up to measure how these improvements relate to reduced costs or increased sales.

### ***Indirect benefits***

A number of intangible benefits have been attributed to the successful integration of supply chains. We will describe four of these benefits to illustrate that they probably exist and they are very elusive to quantify.

#### ***Integrated flow of goods and services***

Achieving an integrated supply chain should mean that there is an improved flow of goods and services through the supply chain. But how does a company measure the benefits? Do they consider the benefit to be primarily in the reduced response time? Suppose at the same time they are reducing the response time, the supplier is required to increase the variety of products they supply. This added

requirement may cause an increase in response time, but it is difficult to know the extent of the benefit if the average response time does not change.

They could also consider the benefit to be a reduction in suppliers. However, suppose they increase the volume and variety of products purchased, thereby needing more suppliers. They end up with the same number of suppliers; does that suggest no progress?

#### ***Faster resolution of problems***

Integrated supply chains should make it easier, and faster, to identify and resolve problems that may occur between customer and supplier. Is the benefit the reduced time required of the participants in the problem-solving effort? On the other hand, is it in the result of the solved problem that makes it possible to get a shipment in time to complete, and ship, a critical order? How much of the value of the total shipment should be assigned to the solved problem?

There may be an even knottier situation. Suppose the problem arises from trying to decide how an operation that was previously done by the customer, say, a retailer, is to be transferred to its supplier, a wholesaler. The problem would not have occurred if the companies were not trying to integrate the supply chain; therefore, should there be any benefit to solving a problem created in this fashion?

#### ***Match customer wants with products provided***

Most would agree that an integrated supply chain should make it possible to more closely match the products provided with what the customer wants. How do you measure this? Can you assume that an increase in percentage of orders filled measures this improvement? If so, what about all of the other actions that helped to increase the fill rate? How do you allocate the benefits and costs among all of the factors involved?

#### ***Reduced excess capacity along the supply chain***

Another benefit of integrated supply chains is a reduction in excess capacity along the supply chain, because of reduced demand variability. Suppose, at the same time, the supply chain's effectiveness results in an increase in demand, so there is no change in overall capacity. We have experienced two significant benefits but we cannot measure the net effect on investment costs represented by the plant capacity.

#### ***Increased Knowledge***

As indicated earlier, most managers would agree that increased knowledge should lead to improved performance, including increased financial returns along the supply chain. However, few managers would be willing to quantify the exact relationship between increased knowledge and increased income. To make the waters even murkier, one study found learning appears to have a positive impact on performance measures relating to end-customer satisfaction and being a more market-focused supply chain. Learning does not appear to affect supply chain performance related to cost. The authors conclude that tacit knowledge (knowledge that resides in the minds of people) is more difficult to transfer than implicit knowledge (knowledge documented in policies and reports). (Spekman, Spear and Karnauff 2002).

The challenges affecting supply chain learning include:

- The natural tension that exist among partnerships regarding cooperation versus competition
- The need to ensure that learning happens throughout the supply chain at the supply chain enterprise, the firm and the individual.
- The need to have a flexible structure to enhance learning

For supply chains to develop a sustainable competitive advantage, the partners must focus on the end-use customer. Learning does have a positive impact on end-use customer focused performance metrics. (Spekman, Spear and Karnauff 2002)

A theoretical model illustrates the increased difficulty of achieving mutual benefits from supply chain improvements. This model identified a requirement for four coordination modes that would lead to supply chain integration. These modes are:

- Logistics synchronization – the value creation loop
- Information sharing – the facilitation loop
- Incentive alignment – the motivation loop
- Collective learning – the capability loop

The model builders believe the successful simultaneous implementation of these integrative loops will help to synchronize interdependent activities, increase visibility to match supply and demand, align the supply chain partners in actions that lead to supply chain profitability, and acquire new capabilities with the supply chain. As a result, all of the participants will recognize a need for matching processes, information, incentives and capabilities, in order to combine their efforts in activities that will benefit the entire supply chain. (Simatupang, Wright and Sridharan 2002)

### **Costs of Supply Chain Programs**

#### ***Direct costs***

In order to achieve some of the benefits described above, companies incur some tangible costs. Some of the more likely costs are described below.

#### ***Communications (IOS)***

One of the primary costs in setting up an integrated supply chain is in designing and implementing an interorganizational communications system (IOS). An IOS requires not only hardware and software but also ongoing consulting and maintenance services. There may be a need for software upgrades and modifications. Often IOS systems require years to fully implement and it is more difficult to accumulate project costs over a multi-year period. However, an IOS will be one of the major costs in setting up integrated supply chains.

#### ***Retraining internal employees***

Retraining employees in the use of new systems can be time consuming and frustrating, for both the employee and the trainer. Formal training classes take time away from the job and may be considered

non-productive; however, they are necessary if the new system is ever to work at a fraction of the level for which it was designed.

### ***Restructure supplier network***

Identifying and organizing the supplier network takes time. Companies must identify the companies they want to include in the supply chain they are designing. These are companies that make a significant contribution to the supply chain; they should be rewarded for their participation. Not every supplier will be included because some will not have a large enough role to make it worthwhile to include them. For those that are included, it will be necessary to identify the key representatives of the organization that will be involved in the eventual distribution process of the proceeds.

Some costs involved in restructuring the supplier network includes the cost of compiling information, meeting with representatives from supplier organizations to develop supplier agreements, time to monitor adherence to the agreements, and other costs that can be directly assigned to this effort.

### ***Design customer network***

Designing a customer network will be at least as costly as designing the supplier network because customers may not be as willing to cooperate in designing a supply chain that shares among its members. Today, many retailers are the largest entities in a supply chain and they may believe that they should command the major share of the benefits, by receiving lower prices from their upstream suppliers. Any suggestions that suppliers should share in the benefits may not be well received by the retail establishment.

### ***Capital investment***

There may be a need for capital investment. For example, in implementing RFID, there is a need to buy equipment for attaching and reading tags. When the investment is required by the same company that gains the benefits, there may not be a problem. However, when the company that gains the benefit, such as a retailer, is not the same as the company that incurs the investment cost, such as a supplier, an imbalance needs correction. Even if chain-level benefits are obvious, an innovation may not go forward if a key participant does not believe it is sharing appropriately in the benefits. (Wouters 2006)

### ***Indirect costs***

By definition, the indirect costs are those costs that are less obvious when trying to create an integrated supply chain. Some examples of these costs include the following.

#### ***Meetings required to organize customer and supplier relationships***

Under direct costs, we listed meetings where the costs of transportation, lodging, and wages can be directly assigned. However, other costs will be less direct, such as informal meetings with other functional areas, telephone conversations or e-mail messages with supplier representatives, and time spent thinking about building the relationship. Usually companies do not try to record these costs and assign them to specific activities.

### ***Programs to change internal culture***

Time will be required to change the internal culture of an organization. While it may be possible to document the costs of formal orientation meetings of groups within the organization, many companies may not consider this necessary or even desirable. Informal meetings of small groups or individuals are even less likely to be documented; however, a considerable amount of time will be required to be sure that the internal employees are on board with the changes being made in the relationships with customers and suppliers, especially if any employee has direct contact with these external entities.

### ***Changes in organization structure***

Changing the organization structure may be easier than changing the culture, but it will take time to consider the changes required, design the revised organization, effect the changes, retrain the affected employees in their new responsibilities, and monitor ongoing operations to assure the new organization structure is working effectively. It is unlikely that any company could, or even try to, accumulate an accurate record of the costs involved in this activity.

### ***Realignment of roles of supply chain participants***

In addition to the realignment of roles within a company, it will also be necessary to realign the roles between companies. A review of individual practices may uncover duplication of effort that can be reduced, or omissions that have to be covered. It takes time to identify what needs to be done, negotiate the agreement of where the activity will be performed, and decide what changes will be required in the day-to-day operations.

### ***Cash flow and time value of money considerations***

The preceding discussion shows that quantifying the value of benefits and costs is difficult, if not impossible, at least impractical, in many cases. Some benefits and some costs will occur over a multi-year period; this suggests the use of time value of money, or discounted cash flow, calculations. However, how do you track cash flow in a multi-unit supply chain? This would appear to be even more difficult than quantifying the individual benefits or costs. Where a company may be involved in multiple supply chains or have operations not directly connected with a known supply chain, the situation becomes even more muddled.

One of the problems may be there are changes in both costs and capital requirements. This makes the redistribution task more difficult. For example, direct costs may decrease but capital investment increases.

An equally daunting task is to factor in changes and realignments of the supply chain over time. New customers enter, old customers leave, new suppliers are added, and old suppliers are discontinued. The start and stop dates do not necessarily correspond with known accounting or calendar periods. Consequently, it is unlikely that the effect of these changes can be considered at all in the total scheme of things.

We described the difficulty of quantifying indirect benefits and indirect costs above. Even more difficult is trying to quantify what might be called intangible costs. While companies may suspect they

exist, they may not always be sure. Determining some of the intangible costs of integrating a supply chain may be as elusive as determining the benefits.

#### ***Loss of confidential information***

One of the dangers of integrating supply chains and beginning to exchange information is the potential for the loss of confidential information. While there is also the opportunity to gain confidential information, it is difficult to assign a value to either type of transaction. If the information were sold, a value could be implicitly assigned; however, when the information exchange is informal, perhaps not even known, no explicit value is present.

#### ***Increased awareness of inequitable treatment among participants***

Closer relationships in integrated supply chains may expose inequitable treatment among participants. This may be in the form of discounts allowed, reduced inspection requirements, or the exchange of birthday cards. Whatever the form and magnitude, someone may object and require mollification. Even if they do not object openly, they may silently worry about it to the point of providing diminished service.

#### ***Discrepancy between contribution and payoff among participants***

One extension of the equitable treatment idea mentioned above may be that a member of the supply chain may believe that they are not getting a fair return on their contribution to the welfare of the supply chain. This may cause them to reconsider the desirability of continuing in the supply chain. If they are an important member, a disgruntled member may adversely affect other participants.

#### ***Legal Actions***

As supply chains become more geographically dispersed and complex, formal written agreements become more necessary to clarify the terms and conditions of exchange, especially when participants are in different countries. Globalization increases the need for documentation and, at the same time, increases the risk of legal actions when disagreements arise. (den Butter and Linse 2008) While the costs of legal actions are very tangible, the likelihood of it becoming a reality is nebulous. Sharing these costs along a supply chain could become a fascinating, but perhaps fruitless, exercise

We have discussed a number of factors that make it difficult to determine the net benefits of an integrated supply chain and the relevant contribution of each member. This does not suggest no attempt should be made to determine the benefits and costs; it does suggest that doing it will be difficult. Later, we describe some cases where dyads of companies made a definite effort to determine the net benefits and find a way to distribute these benefits. However, successes in determining and allocating net benefits are still rare.

### **Considerations for Equitable Distribution among Members**

In this section, we describe some of the things to consider when organizing to distribute benefits among the supply chain participants.



### ***How organize?***

How do you organize supply chain members to develop a cost/benefit distribution system? A facetious answer would be “very carefully.” However, it is a delicate question and one that many supply chains have not yet dealt with. Supply chains have organized carefully to physically move goods and services from the point of origin to the point of consumption. They have also organized to share information, as well as move funds from the point of consumption upstream through the supply chain. However, few have attempted to organize to share benefits.

Do all members participate equally? If not, how do you decide? Is it based on company size? Or amount of goods sold in the supply chain? Or the absence of problems? Or the level of innovation displayed? There are a number of measures that could be used; however, selecting them and measuring them offers a challenge.

Should the participants elect or appoint a steering committee to establish policies and procedures to clarify and prevent, or at least reduce, disputes? Do large companies get more votes?

Is there a need for formal contracts among participants? If the proceeds to be distributed are significant, it is unlikely that informal agreements will suffice. Consequently, there will be a need for formal contracts that spell out the accumulation and distribution process.

Is there a need for a third party to reconcile differences? Suppose the participants cannot agree or do not have written guidelines to follow. Maybe there is a need to have an arbitrator or mediator to work with the parties to come up with a reasonable way to proceed. If so, there will be a need to select the arbitrator. Will the supply chain representatives vote or, in some way, arrive at a consensus?

### ***How distribute?***

If the supply chain participants can arrive at a consensus figure for the net benefit amount, how would these benefits be distributed? One approach would be to distribute the proceeds according to some predetermined weight based on performance. But how do you measure performance, especially the relative performance of different participants? Is it based on effort, or results? Most would vote for results, but this takes us back to the difficulty of determining the identity and value of the results. There seems to be no end of difficulties in determining the financial amounts that may have accrued as the result of effective supply chain integration.

Once determined, how can the benefits be distributed? Should it be in the form of direct payments from one entity to another? How often should the payments be made? Should paper debits and credits be maintained indefinitely? Perhaps participants should make payments into a central pool with distributions to be made at designated intervals.

There is no simple, or objective, answer. It is inevitable that determination and distribution of the proceeds must include judgment and negotiation – judgment as to what should be included and the related amounts – and negotiation as to how the proceeds should be distributed. If the participants try to develop a verifiable methodology, it may take an exhaustive amount of time and erase all of the benefits that could accrue from making the distribution.

## **Role of Prime Mover in the supply chain**

Most supply chains have a single company that is the prime mover of activity in that supply chain. It may be the retailer, such as Wal-Mart, that wants to assure itself of dependable supply. A manufacturer, such as Procter and Gamble, may want to assure itself of a dependable customer network. In this section, we will describe the role of prime movers in a supply chain.

### ***Organize***

Often a supply chain is organized through the initiative of a single company. It is not likely that a group of companies gathered and decided to organize a supply chain. The company that takes the initiative does so because they see an advantage in having a supply chain arrangement. They may not even realize they are setting out on this noble mission; it may start with simply building a relationship with a single customer or supplier and then building onto that beginning.

In recent years, retailers have often been the prime movers to establish working supply chains. Retailers in the clothing sector, especially those in style-oriented clothes such as women's dresses, as opposed to more stable designs, such as men's shirts, have moved toward quick replenishment programs. Typically, a retailer would try to forecast the demand for an assortment of clothes – sizes, styles and colors – and order enough to last the entire selling season, because they would not be able to get replenishment orders before the season ended. With this arrangement, it was inevitable that the retailer ended up with an excess of slower-moving items and stockouts in faster-moving items. Under quick replenishment programs, the retailer could order an assortment to start the season and use replenishment orders for faster-moving items. Quick response programs required close coordination and collaboration between retailer and manufacturer. Obviously, a quick response program offered considerable benefits to the retailer, who often took the initiative in organizing such a supply chain arrangement.

Most businesses of any size will have multiple supply chains. We discussed this requirement in earlier chapters but it is worth repeating that different product categories will probably require different supply chain arrangements. This could mean that a business that is the prime mover for one of their supply chains is only a participant in another of their supply chains.

### ***Select the team***

The organizer of the supply chain system is also apt to design the system to suit themselves. By design, we are referring to the composition of the businesses that are in the supply chain. Ideally, a supply chain requires certain functions be performed and businesses are selected to perform all of the required functions. Sometimes, it is necessary to have some duplication or redundancy in functions, especially in the early stages until the flow of goods and services is well established.

In addition to having businesses that perform the required functions, those businesses must be compatible in technology, organization and culture. Interorganizational communication is essential.

Businesses must be able to freely communicate, usually through electronic media, to exchange information about demand forecasts, actual sales, purchase orders, shipments, payments and all the related normal flow of information. In addition, they need to communicate abnormal information, such as rush orders, impending weather disruptions, and quality problems.

Even with compatible communications technology, businesses may fail to communicate successfully if their organization structures are not compatible. It is more difficult, or at least takes longer, for a business with a rigid and vertical hierarchical line-and-staff organization to complete transactions with a business that has a flat, horizontal structure with empowered employees. The two organizations want to move at different speeds in making and implementing decisions.

Cultures also play a role. An organization with a long history of success may be less willing to consider new ways of operating. If they are the prime mover, they may not have to change much. However, if they are being asked to change in order to accommodate changes the supply chain organizer wants to make, it may take a while for the cultures to mesh.

Organizing a supply chain is more than selecting the best player for each position. It involves getting those players to work together as a team.

### ***Monitor ongoing operations***

Once the supply chain is working, it is important to evaluate its performance. While all members of the supply chain will be interested, the prime moving organization will be vitally interested. It will need to have some way to assess the progress being made in getting participants to cooperate, redundant functions eliminated, service gaps filled, and all of the other problems, both small and large, that can arise in organizing and operating something as complex as a supply chain.

It is unlikely that there will be a neat reporting system to provide this kind of information to the concerned parties. They will have to ask questions, make visits, and challenge delays to uncover the true causes of problems or the deficiencies in the effective workings of the supply chain. Sometimes, the fixes will be as simple as introducing a new purchasing manager to other companies. Often, the fixes will be difficult and of a long-term nature, such as replacing a major software application. As with many programs of this magnitude, monitoring the progress in creating an integrated supply chain is a journey, not a destination.

### ***Evaluate performance***

Even before the supply chain is fully operational, the question of performance measurement should be considered. Performance measurement of a supply chain is different from performance measurement for an individual company. While some measures may be the same – inventory turns or cycle times – they are not necessarily the sum or average of all the participants. Supply chain participants have to agree on the measures used, develop a way to accumulate the information, and design a system to report the results to the appropriate recipients.

### ***Initiate change***

Regardless of how well a supply chain performs, there is bound to be the need for change at some point. When this happens, the prime mover may again have to take the initiative to introduce the change, sometimes at the risk of causing major disruptions in the composition and effectiveness of the supply chain.

A classic example of this occurred when Wal-Mart introduced the idea of replacing bar codes with RFID chips. While the executives at Wal-Mart recognized the magnitude of the change, they believed it necessary for the long-term vitality of their supply chains. There were a number of problems to be solved – the cost of RFID tags, the lack of standards, the investment required for suppliers, and the uncertainty of the reliability of the technology, to name a few.

This has been a multi-year program. Some suppliers resisted because they did not see a return on their investment. Suppliers had to invest in equipment to make and position the tags on cases and pallets for Wal-Mart. Suppliers felt that they incurred the costs and Wal-Mart reaped the benefits. We will come back to this example later in the chapter when we discuss methods of allocating costs and benefits among supply chain participants.

Another example of something that may require the prime mover to take a leading role is in the movement toward green supply chains. While individual companies can “go green,” it is usually difficult for them to do it alone because of the need to coordinate changes in raw materials or packaging. Consequently, companies may more quickly move toward green approaches when they are members of a progressive supply chain.

### **Effect of Changes in Supply Chain Composition**

The changes described in an earlier section have to do with process changes affecting members of the supply chain. However, what if the change required is to change the membership of the supply chain? Is this a simple decision just to replace one supplier with another supplier or is it a more involved decision?

Suppose the supply chain has been carefully crafted by selecting individual businesses that perform designated functions well and, equally important, work with other members of the supply chain as a team member. As the supply chain members begin to acclimate and work together, they form additional links with one another because of being in the same supply chain. For example, two suppliers (A and B) of different, but complementary, parts pool their deliveries to reduce costs and to coordinate the deliveries for the convenience of their customer. Removing one of them as a supplier (A) has implications for both the customer and the remaining supplier (B). Does this mean that the customer should consult with, or be influenced by, the remaining supplier (B) before replacing (A)?

Today, the question posed above may be highly theoretical because most changes are still handled on an ad hoc basis without regard for the secondary consequences. However, as supply chains become

more formal, such as in virtual organizations for building airplanes, there may be a need for a more interactive process in selecting or displacing members.

### ***Dictated by prime mover***

In some cases, such as Wal-Mart, the prime mover may be powerful enough to make changes on its own assessment of the situation. However, most retailers do not have the influence of a Wal-Mart and may have to consider the implications of membership changes. How do they proceed?

### ***Consensus of the supply chain participants***

One of the most obvious ways would be to gain a consensus from among the remaining members of the supply chain. However, suppose there are dozens of supply chain participants. Should they all be consulted, or should an executive committee composed of the key members of the supply chain decide? If so, how should the executive committee be selected? Should the prime mover handpick them, or should the members of the supply chain, with fixed terms of office, vote them on? While this may seem like a theoretical question now, it could become a real question in the future.

### ***Consultation with or outside adviser***

If it is impossible, or impractical, to gain a consensus within the supply chain, it may be possible to call in an external adviser to solve the dilemma. The business community has an array of advising consultants today, and it is clearly within the realm of possibility that another product line could be added for existing supply chain or organizational consultants.

### ***Mediation by third party***

If outside advisers cannot resolve the situation, a further step in the process could be to agree on a mediator to decide what should be done. This is normal practice in labor disputes; it could become a regular practice in supply chain member disputes.

### ***Legal action***

As supply chains become more tightly integrated, and the financial stakes get higher, it may be more difficult to replace one supplier with another. It is conceivable that the day may come when legal action will be required to effect this change. Displaced suppliers may sue for damages; customers may countersue for non-performance; and judges or juries may decide about real, or punitive, damages.

## **Case Studies**

We described why close relationships among supply chain members are necessary for the welfare of the entire supply chain. We also looked at how difficult it is to organize and operate integrated supply chains. It is probably even more difficult to design a way to distribute benefits and costs among the supply chain members. At the present time, there is not a generic way to handle this distribution in all types of businesses. Neither is it possible to outline a general approach that uses macro measures of

such as net income before taxes or return on invested assets. The approach must involve an analysis of incremental benefits and costs arising from specific actions or programs by the affected participants.

In this final section, we include some examples of benefit sharing among supply chain members. They represent the limitations of what is practical and realistic today; tomorrow, new methods may be developed that are more generalizable.

### ***Use of Accounting Records***

One study looked at the use of accounting records to provide information used to decide on the distribution of profits from a specific project. Two companies, a retail supermarket chain and a supplier of hair colorant products agreed to jointly implement an improvement program and share in the proceeds. Using a category management structure, they implemented a number of changes – improved display fixture location, increased space allocation, in-store promotions and increased customer education. The program was a success for both organizations. They collaborated on joint forecasts and discovered the gains in revenues were well above the industry averages. By using accounting records, they were able to agree on a way to share the proceeds from the project. They also learned that the accounting records played an enabling role that opened up strategic possibilities for enhanced cooperation. The companies concluded that the accounting records, originally a control measure, “provided an opportunity for learning and problem solving between category partners and contributed to a higher level of trust.” (Free 2007)

### ***RFID Implementation***

RFID is a technology that is gaining acceptance in a number of applications. The transition to RFID tags from bar codes or from no visible identification is an obvious change. Therefore, it should be one of the changes where costs and benefits can be clearly documented. However, one of the barriers to its adoption is the difficulty in assessing the potential return on investment to members of the supply chain. To date, it appears that retailers gain the largest benefits while suppliers incur most of the costs. One group attempted to design a model that would capture the benefits in five areas: lower operating costs, increase in revenue, lower overhead costs, reduced inventory capital costs, and lead time reduction. While encouraged by the initial results in evaluating the results for one of Wal-Mart’s top 100 suppliers, they concluded, “The difficulty in assessing the potential benefits of RFID implementation is one of the key barriers to adoption of this promising technology.” (Veeramani, Tang and Gutierrez 2008)

### ***Cost Reductions with Investment Requirements***

Sometimes improvement initiatives reduce costs while requiring capital investments. If the benefits are achieved in one part of the supply chain while the capital investment is required in another part, determining the net return on investment becomes more difficult. In such a situation, one empirical study investigated whether companies were able to negotiate a price adjustment that led to a positive economic result for both companies. The study was further complicated by the introduction of a third party, who assumed the capital investment role. The research concluded that the introduction of a capital investment reduces the potential for finding a solution to the distribution problem. The existence of

benefits in the supply chain does not guarantee a mutually acceptable solution can be found. There are several managerial implications from the analysis.

- Use of a net present value (NPV) is appropriate; however, participants should agree to a specific rate at the beginning of the project.
- Price adjustments alone may not be a feasible solution; therefore, managers should be creative in their consideration of redistribution mechanisms.
- Managers should be aware of implementation costs, both within their own companies, as well as in supply chain partners.
- Managers considering the implementation of an innovation should consider the investment goals and negotiating stance of their supply chain partner.

They conclude that the existence of supply chain benefits does not guarantee that an innovation will go forward. (Wouters 2006)

### ***Supply Chain Finance (SCF)***

Supply Chain Finance (SCF) is a means of improving cash flows along the supply chain. The customer – the buyer – gets extended payment terms from the lender – a bank or some other financing organization. The lender pays the supplier after discounting the payment, but at terms they would extend to the larger buyer, which are lower than the terms for the smaller supplier. “The result is that the supplier’s working capital costs are reduced, even though its payment terms have been extended. It is then in a position to convert this cost reduction into price reductions to satisfy the buyer; the buyer gets the benefit of extended terms, lower prices, reduced capital costs and alignment of its procurement and finance interests; and the lender gets the benefit of a higher margin on the exposure to the buyer company.” (Kerle 2007)

SCF has some tangible benefits to the buyers, primarily in reduced working capital needs and enhanced relationships with suppliers. Suppliers gain in increased sales and reduced financing costs. Financiers gain from additional business and reduced lending risk. (Kerle 2007) Are all of these benefits equitable among the parties involved? If not, how are the benefits to be redistributed?

### **Summary**

This has been a review of sharing benefits among supply chain participants. This is a commendable objective; however, only a few supply chains have worked out a way to do this fairly and consistently.

First, we described three phases in supply chain configuration – past (vertical integration), future (virtual integration) and present (loosely coupled). We examined some of the programs that make supply chain integration a potentially beneficial target. A number of these programs have progressed to a level that participants have benefited; however, almost all programs have the potential for added benefits.

In order to share benefits, supply chains must first determine there are benefits and then figure out how to share these benefits among its members. There are tangible and intangible benefits, as well as

tangible and intangible costs. There are also capital investment requirements that may or may not coincide with the benefits and costs.

Before benefits can be allocated, the supply chain needs a structure, or configuration. At present, the configurations are informal and often not very transparent to the supply chain members. Consequently, any agreement to share benefits may end up being done on a project basis, or ad hoc basis, instead of being an ongoing agreement.

There is little in the way of standard approaches to supply chain sharing. This is largely open territory for companies to work on as they continue to improve their supply chain operations. It should provide a worthy challenge for accountants. It should also prove to be a productive area for academic researchers.

### **Opportunities for Future Research**

One area of research that could add to the body of knowledge would be to conduct an empirical study of how companies are presently distributing benefits and costs among supply chain participants. This could include an assessment of how effective the methods are.

Another research study could involve developing a model that could be used to decide how to allocate benefits and costs. As one approach, transfer pricing models from the past could be used as reference points and modified to reflect today's supply chain configurations.

A third area of research could be to develop the specific steps required in moving from a vertical integration mode to a virtual integration mode. While the transition may be perceived as a continuum, there are discrete steps that fall along the continuum.

Finally, there should be some study of the components and structure of supply chains. Supply chains are dynamic and change over time. Do the changes affect the way in which benefits and costs can be equitably allocated?



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## **HUMAN RESOURCE ACCOUNTING'S ROLE IN ORGANIZATIONAL SUSTAINABILITY**

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### **ABSTRACT**

In recent years increased attention has been given to organizational sustainability, with business enterprises strategizing to improve value by striving to address sustainability from a number of perspectives. This paper suggests that Human Resource Accounting (HRA) can facilitate enterprise sustainability. Traditional accounting has treated costs related to a company's human resources as expenses on the income statement that reduce profit, rather than as assets on the balance sheet that have future value for the company. HRA involves accounting for the company's management and employees as "human capital" or assets that provide future benefits. HRA may also include nonmonetary measures relating to an organization's human resources. HRA suggests that the process of measurement, as well as the measures themselves, have relevance in managerial decision-making and result in decisions which are likely to support the organization's long-term sustainability and in turn increase stakeholder value and competitive advantage.

### **INTRODUCTION**

It is noteworthy that many successful companies are increasing their activities to achieve enterprise sustainability from a number of approaches. Sustainability has become a vital part of a competitive business strategy, and organizations that invest in strategies to increase sustainability will have a long-term competitive advantage. Responsiveness to factors which benefit the environment and social performance has been shown to also create stakeholder value.

This paper introduces the field of Human Resource Accounting (HRA) and suggests that it may play a role in facilitating the goals of enterprise sustainability. Whereas traditional accounting has treated costs related to a company's human resources as expenses on the income statement that reduce profit, HRA treats these expenditures as assets on the balance sheet that have future value for the company. HRA involves accounting for the company's management and employees as "human capital" or assets that provide future benefits. An important aspect of the HRA paradigm is the process of measuring human resources, as well as the measures themselves, which have relevance in managerial decision-making. Furthermore the resulting decisions are likely to support the organization's long-term sustainability and in turn increase stakeholder value and competitive advantage.

### **THE WHOLLY SUSTAINABLE ENTERPRISE**

In a recent "White Paper" Deloitte (2007, p. 1) notes that "Companies must undertake sustainability-driven enterprise transformation efforts in order to improve financial, environmental, and social performance." Sustainability may become a significant driver of

enterprise value, but as Deloitte points out, it must generate economic value in order to evolve from an “environmental specialty to a mainstream growth engine.” As discussed in the Deloitte White Paper (2007, p. 1) “Wholly Sustainable Enterprise” has been defined as an entity that drives stakeholder value throughout the entirety of its activities, including products and services, workforce, workplace functions/processes, and management/governance. In order to create consistent long-term value the traditional definition of “green principles” is extended to incorporate the entire activity base of the organization.

According to Deloitte (p. 4), five major platforms where sustainability principles can be applied in the transforming an organization to the Wholly Sustainable Enterprise are as follows

- “The Green Products/Services Portfolio” including waste and pollution management, resource replacement, sustainable design, adaptive reuse.
- “The Green Workforce” including human resource strategies, culture, recruiting and retention, training, career path development, and diversity.
- “The Green Workplace” including global locations, physical plant, ergonomics, virtual workplace, green buildings, environmental discharge, waste, and energy use and source.
- “The Green Function/Process Model” including sustainability applied to traditional functions, enterprise-wide green process modeling to incorporate green practices and sustainable management.
- “Green Management and Governance Principles: including board and management accountability, sustainability test, compliance, incentives, ethics, reporting and assurance.

Each of the above platforms is a component providing defined applications of moving toward “greening the company” across each element of the organization. Taken together the combination of efforts results in a fundamental change of the organization to a Wholly Sustainable Enterprise. As Deloitte (p. 2) points out, leading companies and public sector organizations are showing environmental and social performance while at the same time delivering the creation of shareholder value. Deloitte (p. 8) indicates that, as a number of organizations make the sustainability transformation, a fundamental transformation will take place in the social, governmental, and environmental spheres in which they reside. In effect they will drive the types of changes advocated by politicians and environmentalists—but with the important difference that the improvements will result from growth, profitability, employment and value rather than from conflict, regulation and premium costs.

As noted by Deloitte (p. 2) beginning in the late 1990s many organizations began to investigate ways to measure and report sustainability, and there has been an increase in reporting on environmental and social performance. There is no one right way for companies to report on these issues. Deloitte (p. 4) observes that companies are reporting differently on sustainability and corporate social responsibility requirements, priorities and progress. The purpose of this paper is to introduce Human Resource Accounting and suggest that HRA may be a useful element of organizational reporting for sustainability. And in addition the very process of HRA measurement may encourage management to act in line with the goals of increasing enterprise sustainability and corporate social responsibility.

## **HUMAN RESOURCE ACCOUNTING (HRA)**

The early stages in HRA development, particularly from 1971-1977 as noted by Flamholtz, Bullen and Hua (2002, p.949), was a period of rapid growth of interest in the field and involved a significant amount of academic research throughout the Western world and in Australia and Japan, with increasing attempts to apply HRA in business organizations. During this time, the American Accounting Association (1973) established committees on Human Resource Accounting in 1971-1972 and 1972-1973. These committees published reports on the development of HRA, and the AAA's involvement proved a catalyst for a stream of research during this period.

### **Development on HRA Measurement Models**

Research during the early stages also involved the continued development of concepts and models for measuring and accounting for human resource cost and value. According to Flamholtz's model for measurement of original human resource costs (1973, 1999, p. 59), human resource costs may be explained in terms of the two major categories of acquisition costs and learning costs. Acquisition costs include the direct costs of recruitment, selection, hiring and placement, and the indirect costs of promotion or hiring from within the firm. Learning costs include the direct costs of formal training and orientation and on-the-job training. In a human resource accounting system, these costs are reported in asset accounts with future economic benefits rather than as expenses.

Another HRA model, the Stochastic Rewards Valuation Model (SRVM), originally developed by Flamholtz (1971) and further explained in Flamholtz (1985, 1999), focused on HRA value rather than HRA cost. Flamholtz utilized both nonmonetary and monetary measures in drawing upon both behavioral and economic variables. The Flamholtz model proposes that an individual's value to an organization is based on the future services that are expected to be rendered to the organization in future roles or service states, and views the movement of people among organizational roles over time as a Markovian stochastic or probabilistic process with service rewards. The SRVM is a multi-step process that begins with defining the various service states or organizational positions that an individual may occupy in the organization, and then determines the value of each state to the organization, the service state values which can be calculated either by using a number of methods such as the price-quantity method or the income method. Next the person's expected tenure or service life in the organization is calculated and the person's mobility probability or the probability that a person will occupy each possible state at specified future times is derived from archival data. The model follows with discounting the expected future cash flows that the person generates in order to determine his or her present value. As Flamholtz (1999, pp 160-161) indicates, there is a dual aspect to an individual's value—"expected conditional value" and "expected realizable value." The first, a person's expected conditional value, is the amount the organization could potentially realize from a person's services if that person maintains organizational membership during the period of his or her productive service. The second, a person's expected realizable value, is the amount actually expected to be derived, taking into account the person's likelihood of turnover.

## **Continuing Developments in HRA Research and Applications**

The earlier HRA studies emphasized the need for future research in the field, and a number of researchers continued or began work in the area. As noted in Sackmann, Flamholtz and Bullen (1989), Flamholtz, Bullen and Hua (2002), and Flamholtz, Kannan-Narasimhan and Bullen (2004), throughout the ensuing years many studies were conducted in the area of HRA. Some of the most interesting research recognized significance to organizations of the process HRA measures, as well as the measurements themselves.

### **Effects of the Process of HRA Measurement in Decision-Making**

As much as the measures themselves are relevant in managerial decisions, it is also useful to recognize that when managers go through the process of HRA measurement treating human resources as capital assets, they are more likely to make decisions that treat the company's employees as long-term investments of the company. Flamholtz (1979) describes the HRA paradigm in terms of the "psycho-technical systems" (PTS) approach to organizational measurement. According to the PTS approach, the two functions of measurement are: 1) process functions in the process of measurement and 2) numerical information from the numbers themselves. Whereas one role of HRA is to provide numerical measures, an even more important role is the measurement process itself. The HRA measurement process as a dual function attempts to increase recognition that human capital is paramount to the organization's short and long-term productivity and growth. When managers go through the process of measuring human resources, they are more likely to focus on the human side of the organization and are more likely to consider human resources as valuable organizational resources who should be managed as such.

For example, in a potential layoff decision with use of HRA measures rather than only traditional accounting measures, management is better likely to see the hidden costs to the company's human resources and the long-term implications to the human assets. This is because HRA views human resources as assets or investments which must be maintained for long-run productivity. Layoffs may affect future long-term flows profits from lost productivity, costs of rehiring and retraining when business returns, and costs of lower morale of existing workforce. If management quantified the actual costs of layoffs, management might be less inclined to use layoffs as a way to cut costs and boost short-term profits at the expense of long-run productivity and profits.

### **HRA Measurement**

As noted earlier in the discussion of HRA model development, according to Flamholtz (1999, p. 160), the concept of human resource value is derived from general economic value theory, and like all resources people possess value because they are capable of rendering future service. Thus as Flamholtz notes, an individual's value to an organization can be defined as the present value of the future services the individual is expected to provide for the period of time the individual is expected to remain in the organization.

Using the Stochastic Rewards Valuation Model, originally developed by Flamholtz (1971) for human resource valuation, and further explained in Flamholtz (1985, 1999), Flamholtz, Bullen and Hua (2003) showed a practical method for calculating ROI on management development, and reported the incremental cash flows that an organization will receive due to investment in management development. The article concluded that use of HRA as a tool to measure the value of management development enhances not only the value of human capital but also the value of management accounting. The authors utilized the HRA measure of expected realizable value, and found that employees' participation in a management development program increased the value of the individuals to the firm. In addition the authors noted (p. 40) that the HRA measures provided upper level management with an alternative accounting system to measure the cost and value of people to an organization. Thus HRA represented both a paradigm and way of viewing human resource decisions, and the set of measures for quantifying the effects of human resource management strategies upon the cost and value of people as organizational resources.

Davidove and Schroeder (1992) indicate that too many business leaders have no generally accepted definition or accounting procedure for tracking training investments, and note that a lower training investment is not automatically better for an overall return on investment. The authors suggest that although many business leaders still view training as an overhead expense, with thorough ROI evaluations, training departments can convince business to view them as partners in creating the assets crucial to organizational success.

Other authors have expressed similar views suggesting the benefits of HRA measurements and the process of measuring human resources. For example Johanson and Mabon (1998) indicate that expressing human resource interventions in financial terms and /or cost benefit terms is more effective than using soft accounting information such as data on job satisfaction. Because the classical function of accounting is the determination of the value of the economic activity, performing analysis with hard numbers such as cost-benefit analyses helps us determine how resources should be used by human resources for various interventions. McKenzie and Melling (2001) suggest that, if properly implemented, the human capital planning and budgeting process will become a key driver of strategy in that strategic human capital planning and budgeting ensures that the best resources are mobilized for each internal process. They indicate that too often organizations focus 100% on meeting the financial budget first without consideration of the effect the cost slashing will have on strategy, and note that the financial numbers are a lagging indicator of where a firm has been and should not be substituted for leading indicators of where the firm is going. Rather management should focus clearly on causal, leading indicators that drive successful financial measures, and that it is through skills-based budgeting that the fallacy of financial focus can be avoided.

Moore (2007) suggests that the value of human capital should be more fully considered when making decisions about the acquisition and disposal of people—and notes that the accounting practices currently employed by companies can have an undue influence in driving the strategic decisions of these companies. Moore notes that there are parallels between the process of acquiring an employee (a human capital asset) and that of acquiring a fixed capital asset in overall financial success. Bullen and Kordecki (2008) suggest that inclusion of human resource capital investment decisions in managerial capital budgeting decisions is expected to have implications from the standpoint of providing measures that can compete with other investment

proposals for the firm's resources, and demonstrate that the long-term benefits from such investments can be positive. Flamholtz (2005) investigated conceptualization and measurement of the economic value of corporate culture—described as “human capital of the third kind.” The results of the empirical study showed that organizational culture does have an impact on financial performance, that corporate culture can be measured, and that implications of the study included a new direction for HRA.

## CONCLUSIONS AND IMPLICATIONS

HRA shows interesting origins based on a changing economic environment, and a multi-faceted growth continues in the field. Over the years HRA has advanced through theoretical studies, empirical research, and case and field studies. Development of HRA has included both monetary and nonmonetary measures. Study of HRA complements the wider study of human capital, intellectual capital, managerial economics and organizational management. HRA has implications as one of the measurement approaches for organizations striving to broadly improve sustainability. As noted by Deloitte (p.5) “Importantly, we expect to see continued evolutions of triple bottom-line reporting to explore the inter-relationship between financial results and the non-financial aspects of performance, focusing on where well-planned and executed sustainability initiatives can drive value (improved financial performance) as well as improved outcomes in social and environmental outcomes than viewing them as trade offs to one another.”

Both the inclusion of HRA measures and the actual process of measuring these HRA measures in managerial decisions have implications for organizations in building sustainability. HRA involvement in the organization provides information that facilitates human resource investment with other investment proposals for the firm's resources, and demonstrates that the long-term benefits from such investments can be positive. Companies that invest in their human resources are at an advantage in building a sustainable transformation.

The very process of HRA measurement can influence management to think in terms of expenditures for the company's human resources as increasing the value of human capital or human assets that will provide future benefits to the company, rather than in terms of expenses. Decisions which may be motivated by the process of HRA measurement are in line with the company's strategic focus on building a Wholly Sustainable Enterprise, particularly along the dimensions of the Green Workforce and the Green Management and Governance Principles. This “green” approach is expected to promote a longer-term profit perspective compatible with a long-term strategic enterprise sustainability planning approach for the organization, rather than a strictly short-term profit perspective which may neglect maintenance and jeopardize the firm's human resources. Companies that do not pay attention to sustainability issues on multiple dimensions—especially their human resources—run the risk of losing a competitive advantage. As noted by Deloitte (p. 7) “Companies that are ‘sustainable’ across the entirety of their activity base will drive improved short-term profitability and long-term stakeholder value, while contributing to permanent betterment of social and environmental issues. By virtue of this win-win proposition, these are the companies that will sustain themselves indefinitely.” The most important elements of an organization's activity base are its human resources. HRA recognizes the long-term security of its most valuable capital investments and assets—its human assets—



and in turn helps the organization become a Wholly Sustainable Enterprise promoting social value and at the same time value in terms of increased long-term profits for its stakeholders.

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# University Data Breaches 2005-2009

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## ABSTRACT

This paper gives an analysis of reported data breaches at universities and colleges in the U.S. Categories of breached data are introduced and analyzed based on breach incidents and related records. Analysis of breach data are made based on category, year of reported breach, and the state where the breach occurred. The results reveal that 31% of the universities have had multiple incidents and that there was no causal relationship between the total number of incidents per category and the total records breached per category. However, the breached records for universities ranged from 159,333 to 5,326,969 records across categories; the number of incidents across categories ranged from 5 to 97. In addition, specific patterns of vulnerability at universities were observed.

## KEYWORDS

Computer breach, computer security, data breach, identity theft

## INTRODUCTION

The Federal Trade Commission (FTC) 2009 Congressional Budget Justification states that identify theft remains the top consumer complaint [4]. In 2007, over 800,000 fraud and identify theft complaints were recorded in the Consumer Sentinel, a database developed and maintained by the FTC [5]. In recent years, efforts have been made to reduce cyber crime activity. The United States Computer Emergency Readiness Team (US-CERT) [3] offers response support and defense against cyber attacks through cyber security alerts, bulletins and tips about current security concerns, vulnerabilities and exploits. They focus on making both the public and industry aware of security issues through publications, posters, pamphlets and monthly and quarterly reports about cyber crime.

Computer security researchers are continuously trying to improve data security with a large variety of techniques. Hazay and Lindell [7] use standard smartcard infrastructure to build efficient secure protocols, with emphasis on maintaining the privacy of sensitive data, for commercial, governmental and security agencies. Dynamic taint-analysis [8, 9] identifies suspicious data as tainted, and tracks the processing of the tainted data to monitor its use in a system. Enhanced and improved techniques, based on dynamic taint-analysis, have been used to enforce security during software execution. Chang, Streiff and Lin [1] developed a system which uses dynamic data flow analysis to enforce security policies in a program, after identifying locations in the program where security violations might be possible. Xu, Bhatkar and Sekar

[10] provide an effective security attack detection technique that tracks suspicious data through programs, in multiple languages for different types of applications, at the granularity of bytes. This method examines the origin of each byte of data that is used in security-sensitive operations.

In spite of the vast research in computer security, frequent data breaches still occur. Dr. Eugene Schultz, Principal Computer Engineer, University of California-Berkeley Lab and editor-in-chief of Computers & Security has said that universities are among the least secure places in the universe relative to computers [6]. In this paper, we analyze the affect of computer data breaches on universities and colleges.

## **DATA**

We obtained our data for this study from the chronology of data breaches maintained by the Privacy Rights Clearinghouse [2]. The data breaches provided by the clearinghouse have been reported from a variety of enterprises, however, we focus on breaches that have been reported by or about colleges and universities from January 2005 to June 2009, a four and a half years time period. Whenever, we refer to the year 2009, we are referring to the first six months of that year. The other four years are complete calendar years. The dates used by the clearinghouse and in this research refer to the data the incident was first made public. The breach may and in many cases did occur months earlier.

Analysis of the data revealed five categories of data breaches for 152 universities: Stolen, Hacker, Insider, Exposed and Missing. The Stolen category includes stolen hardware such as desktop computer, laptop, server, flash drive, and hard drive. The Hacker category covers unauthorized remote computer break-ins. Insider involves misuse of access/authority of computer usage by an employee or former employee. The Exposed category involves unprotected data that may be publically accessible and includes records exposed in email, regular mail, online and through disposal. The Missing category includes missing disks, files, hard drives, flash drives, tapes, laptops, computers and servers. The breached data contained personal information, such as social security number, about current and former employees and students, alumni, patients and other individuals who utilized the services of the universities.

# ANALYSES OF BREACHED RECORDS

## Breach Records Overview

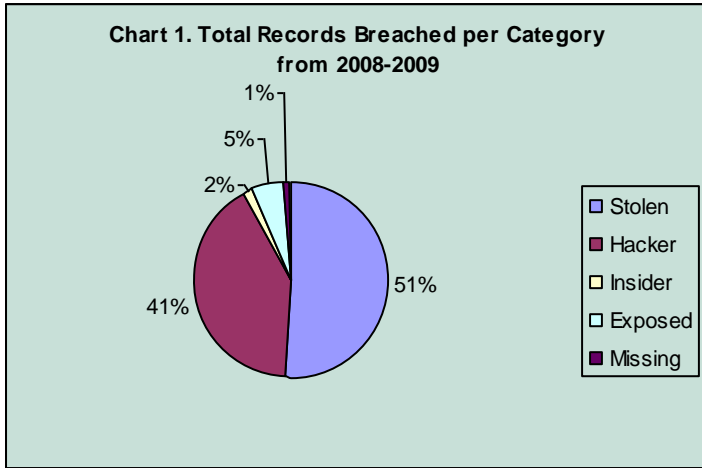


Chart 1 shows the total records breached in each category from 2005-2009. Over four and a half years, over 50% of the breached records at universities are in the Stolen category, followed by 41% in the Hacker category. The Exposed category had the next highest percentage of breached records, 5%, a difference of 36 percentage points from the Hacker category. The Insider category accounted for 2% of the breached records, followed by the Missing category with only 1%. The low percentage of breached records in the Insider and Missing categories could be indicative of good internal security controls. Chart 1 suggests that university security policies are more effective on the activities in categories that are more immediately controllable. An insider is aware of the consequences of a violation of security policy and has to deal with the fear of being caught and losing employment. Perhaps, an insider is less likely to steal a large number of records in order to not be noticed; and is less likely to repeat an incident. Many universities have strict guidelines to protect against the exposure of files, software, email, secondary storage devices, laptops and other computer equipment. Thus, alert employees can affect the percentage of records breached in the Exposed and Missing categories.

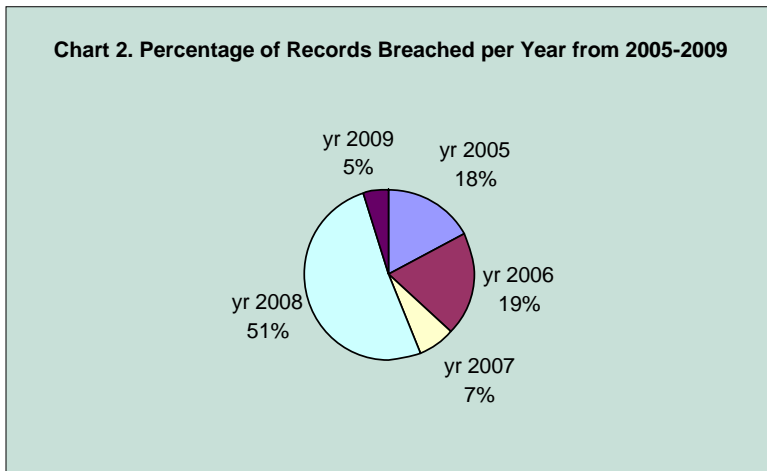


Chart 2 shows the percentage of records breached each year from 2005 to 2009. Over 50% of the records were breached in 2008, followed by a distant 19% in 2006. In 2005, the first year of the study, 18% of the records was breached. In 2007, 7% of the records were breached. The first six months of 2009 account for 5% of the breached records.

### Details of Breached Records

Table 1 shows that millions of records have been breached from 2005 through June 2009 at universities. Personal information of thousands of students, faculty, staff and patients has been obtained and possibly used by unauthorized persons. Here, we make observations about the number of records breached per category, for each year.

	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2005-2009 TOTAL</b>
<b>TYPE</b>						
<b>STOLEN</b>	315,451	177,818	135,113	4,632,493	66,094	<b>5,326,969</b>
<b>HACKER</b>	1,300,163	1,760,180	371,650	532,286	323,525	<b>4,287,804</b>
<b>INSIDER</b>	150,000	4,719	0	4,614	0	<b>159,333</b>
<b>EXPOSED</b>	35,212	48,106	199,874	133,326	115,477	<b>531,995</b>
<b>MISSING</b>	37,000	26,816	25,735	51,442	0	<b>140,993</b>
<b>TOTAL</b>	<b>1,837,826</b>	<b>2,017,639</b>	<b>732,372</b>	<b>5,354,161</b>	<b>505,096</b>	<b>10,447,094</b>

We look first at the two breach categories where the majority of records were breached, Stolen and Hacker. In the Stolen category, from 2005 to 2007, the total records breached decreased from 315,451 to 135,113. However, in 2008, there was a steep spike in the number of compromised records, 4, 632, 493. This spike was due to two incidents in which over 2 million records were breached. In April and June of 2008, tapes containing 2,100,000 records and 2,200,000 records, respectively, were stolen from two different university medical centers. When we do not consider these two stolen incidents for this year, only 332,493 records were breached. However, this number is still an increase in the number of records breached in 2005, 2006, or 2007. The number of records stolen from January through June of 2009 is 66, 094.

An observation of the Hacker category reveals that over 3 millions records were breached from 2005 to 2006, the two years with the highest number of Hacker incidents. In 2005, 1,300,163 were compromised, where the greatest number of records breached in a single incident was 270,000. In 2006, 1,760,180 were compromised, where the greatest number of records breached in a single incident was 800,000. In 2007, there was a sharp decrease in the number of records (371,650) breached due to hacking. Then, in 2008, there was an increase to 532,286, with a single incident at a university dental school accounting for 330,000 of those records. For the first six months in 2009, 323,525 records have been breached. The total number of records breached in the Stolen and Hacker categories from 2005-2009 is 9,614,773, which is 92.03% of all the breached records.

We also note the months for each year in which no Hacker incidents were reported. In 2005, there were no incidents in February, October or November. In 2006, there were no incidents in January, October or November. For the years 2007 and 2008, there were no Hacker incidents reported for five months out of these years. In 2007, no incidents were reported for January, March, August, September and November. In 2008, no incidents were reported for February, June, August, October and December. For 2009, a hacker incident has been reported for each month.

From 2005 to 2007, there were steady and sharp decreases in breached records in the Insider category. A single insider incident for 2005 caused the breach of 150,000 records. Then in 2006, a single incident for the entire year resulted in 4,719 breached records, followed by zero insider breached records in 2007. However, in 2008, three insider incidents caused the breach of 4,614 records. The first part of 2009 shows no records breached thus far in this category.

The number of records in the Exposed category increased each year from 2005-2007. In this category, the largest amount of records exposed was in 2007, 199,874. In fact, this is the only year in which the records in the Exposed category surpassed the breached records for the Stolen category. In 2008, there is a decline, however, in 2009, 115,477 have already been compromised for the first part of the year.

It is worth noting how the majority of the records were exposed for each year. From 2005 to 2007, the majority of the records in the Exposed breaches were exposed on-line. In 2005, 34,012 were exposed on-line; in 2006, 30,031 were exposed on-line; in 2007, 164,754 records were exposed on-line. In 2008, two types of exposures were responsible for the majority of the records: online (57,174 records) and regular mail (55000 records). In 2009, 100,000 were exposed in storage.

In the Missing category, the number of breached records decreased from 37,000 to 25,735 during the first three years. Then, in 2008, the number of breached records almost doubled that of 2007. In 2005, there was only one breach incident; a missing laptop resulted in the breach of 37,000 records. In 2006, files containing 21,000 records went missing. In 2007, there was a missing computer (containing 8,000 records) and a missing flash drive (containing 16,000) which contributed to this year's loss. In 2008, most of the missing data was on flash drives (containing 24,990 records) and tape (containing 21,000 records). No breaches have occurred in 2009 for the months in this study.

<b>TABLE 2. PERCENTAGE OF RECORDS BREACHED PER CATEGORY FOR EACH YEAR</b>					
<b>2005</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>TYPE</b>					
<b>STOLEN</b>	17.16	08.81	18.45	86.60	13.09
<b>HACKER</b>	70.74	87.24	50.75	9.95	64.05
<b>INSIDER</b>	08.16	00.23	00.00	00.00	0.00
<b>EXPOSED</b>	01.92	02.38	27.29	2.49	22.86
<b>MISSING</b>	02.01	01.33	03.51	00.96	0.00

Table 2 shows the percentage of all records compromised in each category per year. This table is derived from Table 1. For each column, the value is obtained by dividing the corresponding number of records by the total for that column in Table 1. This table helps us to see the distribution of breached records for each year. We can easily see that over 50% of the records that were compromised in four years were due to incidents in the Hacker category. On the other hand, we see that the Insider and Missing categories have the lowest percentages of breached records for four and one half years. Also, we can see that in 2007 and 2009, the breached incidents are less concentrated in the Hacker category, and more occur in the Stolen and Exposed categories.

<b>TABLE 3. PERCENTAGE OF RECORDS BREACHED EACH YEAR FOR A GIVEN CATEGORY</b>					
<b>2005</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>TYPE</b>					
<b>STOLEN</b>	05.92	03.34	02.5	86.96	01.34
<b>HACKER</b>	30.32	41.05	08.68	12.41	07.55
<b>INSIDER</b>	94.14	02.96	0.00	02.90	0.00
<b>EXPOSED</b>	06.62	09.04	37.57	25.06	21.71
<b>MISSING</b>	26.24	19.02	18.25	36.49	0.00

Table 3 shows the percentage of records breached within a given category for each year of the study. To derive this table, we focus on one category at a time, that is, a single row, in Table 1. To obtain the values, divide the records breached for a given year by the total for that category. For the Stolen category, we divide 315,451 by 5,326,969 to get the percentage of stolen records for 2005. For each year, we divide the value in the Stolen category by the total for that row. We do the same for the remaining categories.

This table allows us to observe similarities and differences in the distributions of the percentage of records breached across categories. It is very informative about patterns within each category and patterns between categories. For the Stolen category, the largest percentage of stolen records (86.96) occurred in 2008. The largest percentage of Missing records (36.49) also occurred in 2008. The largest percentage of Hacker records breached during a year is 41.05, which occurred in 2006. The Insider category has 0.00 percent records compromised in 2007 and 2008, and in 2005, 94.14 percent of the records in this category were compromised. For the Exposed category, 37.37 is the highest percentage of records breached (2007). From 2005 to 2007, we see the percentage points decrease for Stolen and Insider categories, while the Exposed category percentage points increase for these years. When only the full years are considered, in 2007, the Exposed category's highest percentage, 37.37, occurs, while in that same year, the other four categories have their lowest percentage of compromised records.

We can also spot when the percentage of breached records is very close for a given year. In 2005, 5.92% of records were breached in the Stolen category and 6.62% of the records were breached in the Exposed category. In 2006, 3.34% were compromised in the Stolen category and 2.96% records were compromised in the Insider category.



## ANALYSES OF BREACH INCIDENTS

### Breach Incidents Overview

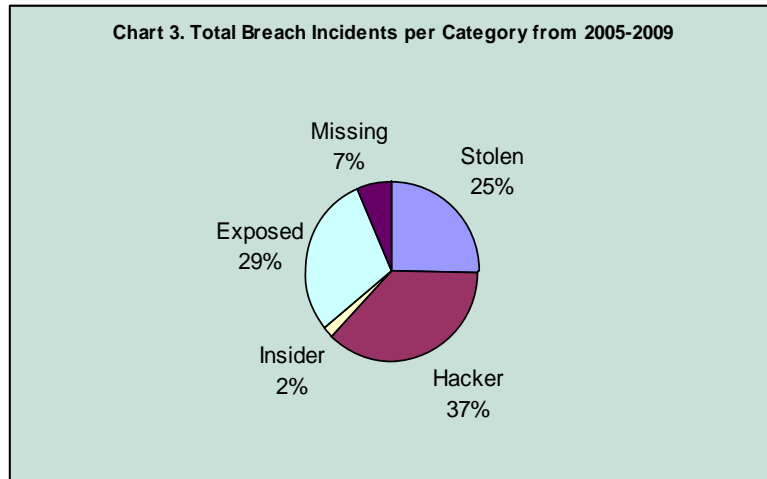


Chart 3 shows the percentage of breach incidents for each category from 2005-2009. We see that the majority of the incidents, 37%, occur in the Hacker category, followed by Exposed (29%) and Stolen (25%) categories. The large percent of Hacker incidents is not surprising since these are aggressive, impersonal and remote occurrences, and perhaps more difficult to control due to a variety of attacks and uncertainty about the nature or source of the attack. However, it is surprising that the Exposed category would have the second largest percentage of incidents because it implies a lack of enforcement of university security protocols for protecting data. In general, Exposed data is a passive, non-aggressive event that might go unnoticed for an extended period of time, thus employees should be vigilant in attempting to detect incidents in this category. Insider and Missing breach incidents have the lowest percentages. The reason for low percentages of incidents in these two areas is probably due to the direct implications to employees. A dishonest employee, in order to reduce the possibility of being detected, is likely to be very selective about the time, place and opportunity to participate in a breach incident. Missing computer hardware can usually be tied to the employee who is responsible for it, so, in order to avoid negative consequences, the employee is likely to protect it diligently.

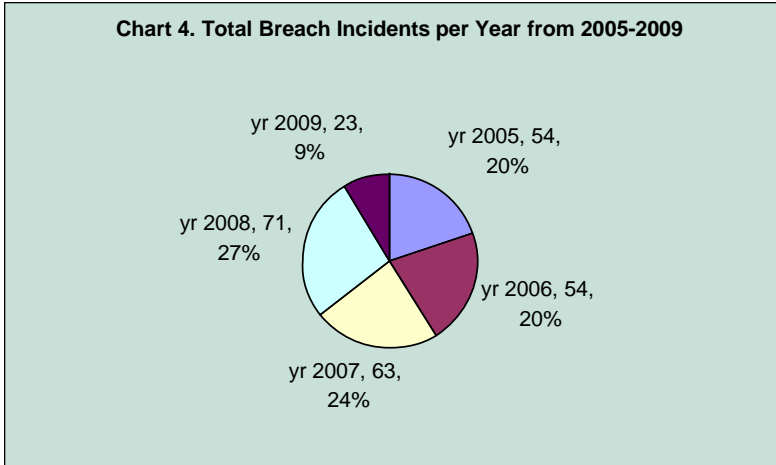


Chart 4 shows the percentages of breach incidents for each year. This chart shows that 2005 and 2006 have the lowest percentages, 20% each, for the full calendar years. However, there is an increase by four percentage points in 2007 and then another increase by three percentage points in 2008. There might be a decrease in 2009, since only 23 incidents have occurred in the first six months.

**Breach Incidents in Detail**

<b>TABLE 4. NUMBER OF INCIDENTS PER YEAR</b>						
<b>TYPE</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>TOTAL</b>
<b>STOLEN</b>	9	15	16	20	7	<b>67</b>
<b>HACKER</b>	38	20	16	14	9	<b>97</b>
<b>INSIDER</b>	1	1	0	3	0	<b>5</b>
<b>EXPOSED</b>	5	13	25	28	7	<b>78</b>
<b>MISSING</b>	1	5	6	6	0	<b>18</b>
<b>TOTAL</b>	<b>54</b>	<b>54</b>	<b>63</b>	<b>71</b>	<b>23</b>	<b>265</b>

Table 4 shows the number of incidents that occurred in each category for each year. In 2005 and 2006, the number of breach incidents was equivalent, 54. In 2007, the number of incidents increased by 9. Again, in 2008, there was an increase in the number of incidents, from 63 to 71. During the first six months of 2009, there have been 23 incidents, suggesting a possible downward move in the total number of incidents in 2009.

From 2005 to 2008, the number of incidents increased in the Stolen, Exposed and Missing categories and decreased for the Hacker category. For the Insider category, there was one incident in 2005 and 2006, none in 2007 and 3 in 2008. The decrease in Hacker incidents over the years could be due to Universities’ increased efforts to prevent unauthorized remote access.

<b>TABLE 5. PERCENTAGE OF INCIDENTS IN EACH CATEGORY FOR A GIVEN YEAR</b>					
<b>TYPE</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>STOLEN</b>	16.67	27.78	25.40	28.17	30.43
<b>HACKER</b>	70.37	37.04	25.40	19.72	39.13
<b>INSIDER</b>	1.85	1.85	0.00	4.23	0.00
<b>EXPOSED</b>	9.26	24.07	39.68	39.44	30.43
<b>MISSING</b>	1.85	9.26	9.52	8.45	0.00

Table 5 shows the percentage of incidents in each category for a given year. It is derived from Table 4. The values in each column in Table 4 are divided by the total for that column. We can see when categories have the same percentage of records for a year: Stolen and Hacker categories have 25.40 for 2007 and Missing and Insider have 1.85 for 2005. The Hacker category has over 70% of the incidents in 2007, however, in the other years the incidents are not so heavily concentrated in a single category. In 2007 and 2008, the percentages of breach incidents were greater than those in Hacker and Stolen categories. The Insider category has the overall lowest percentages for breach incidents.

<b>TABLE 6. PERCENTAGE OF INCIDENTS IN EACH YEAR FOR A GIVEN CATEGORY</b>					
<b>TYPE</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>STOLEN</b>	13.43	22.39	23.88	29.85	10.45
<b>HACKER</b>	39.18	20.62	16.49	14.43	9.28
<b>INSIDER</b>	20.00	20.00	0.00	60.00	0.00
<b>EXPOSED</b>	6.41	16.67	32.05	35.90	8.97
<b>MISSING</b>	5.56	27.78	33.33	33.33	0.00

Table 6 shows the percentage of breach incidents within a given category for each year of the study. To derive this table, we focus on one category at a time, that is, a single row in Table 4 and divide the breach incidents for a given year by the total for that category. We see that the larger percentages for Stolen, Exposed and Missing categories occur in 2007 and 2008. The larger percentages for the Hacker category occur in 2005 and 2006. The Insider category has its largest percentage in 2008. For the full calendar year 2006, the percentage distributions for all categories are relatively close, from 16.67 to 27.78. The percentages are also quite close for the first six months of 2009.

## Repeat Incidents at Universities

<b>Univ. Id.</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>TOTAL</b>
<b>CA 1</b>	4	1	0	0	0	<b>5</b>
<b>CA 2</b>	6	1	4	2	2	<b>15</b>
<b>CO 1</b>	3	2	1	0	0	<b>6</b>
<b>FL 1</b>	0	0	1	3	2	<b>6</b>
<b>IA 1</b>	0	2	2	2	0	<b>6</b>
<b>IN 1</b>	1	2	3	0	1	<b>7</b>
<b>MO 1</b>	0	1	4	0	0	<b>5</b>
<b>OH 1</b>	2	0	1	2	1	<b>6</b>
<b>OH 2</b>	0	3	0	2	0	<b>5</b>
<b>TX 1</b>	0	0	2	3	0	<b>5</b>
<b>TX 2</b>	0	3	0	3	0	<b>6</b>
<b>TOTAL</b>	<b>16</b>	<b>15</b>	<b>18</b>	<b>17</b>	<b>6</b>	<b>72</b>

There were 47 universities that experienced two or more breach incidents from 2005 to 2009. Table 7 shows universities that had 5 or more incidents during this time period.

The first column is the university identification code: state name followed by a sequence number for the university in that state. For each university, multiple incidents occurred within at least one of the years. In 2005, CA1, CA2 and CO1 had their largest number of incidents. CA1 had no incidents in the last three years, and CO1 had no incidents in the last two years. However, CA2 had incidents in all five years, for the highest total of 15. FL1 and TX1 had no incidents in the first two years, but they both had a high of 3 incidents in 2008. OH2 and TX2 had no incidents in 2005, 2007 and 2009, but they each had a high of 3 incidents in a year. The largest number of repeat breach incidents occurred in 2007.

We observed the timeline and nature of the breach incidents for these universities. For CA1, there were four hacking incidents in 2005, one reported in March and the other 3 reported in July and August. CA2 had 5 hacker incidents and 1 stolen laptop reported within the first seven months of 2005. In 2007, CA2 also had missing files, a stolen computer and two hacker incidents from April to June. MO1 had two exposed online incidents and one stolen incident reported on the same day in November of 2007. A few weeks earlier, in October, a hacker incident was reported at MO1. FL1 had two exposed incidents reported in May and June of 2008, and then a hacker incident later that year, in November, that resulted in 330,000 breached records from the Dental school. IN1 had exposed online incidents reported in April, July and September in 2007. IA1 reported one hacker incident in each year from 2006 to 2008. TX1 had one hacker incident and two exposed online incidents reported in 2008. TX2 had 2 exposed online incidents in July 2008 and one exposed mail incident reported in April of that year. For OH1, four of the six incidents from 2005 to 2009 were in the Exposed category. OH2 had 3 hacker incidents reported between April 24 and May 4 of 2008, which resulted in the breach of more than 362,000 records.

## FINDINGS AND CONCLUSIONS

In this study, we analyzed breach incidents at universities and related breached data over a four and a half year period. We compared data in five categories of breaches: Stolen, Hacker, Insider, Exposed and Missing.

Over 10 million records have been breached at universities from 46 states and Washington DC in the four and a half year period covered by this study. The Stolen category had the largest number of records compromised, 5,326,969, and the Missing category had the smallest number of breached records, 140,993. Hacker, Exposed and Stolen had the largest number of incidents of breached data, 97, 78, and 67 respectively.

The full calendar year with the smallest number of records compromised was 2007, 732,372. The number of incidents for this year, 63, is 9 percentage points higher than the smallest number of incidents for a year, 54. The year 2008 experienced the largest number of compromised records, 5,354,161; however, there were only 54 incidents for this year. Based on the data for the 6 month period in 2009, the Hacker and Exposed categories are likely to experience an increase in breached records. There are no incidents for the Insider and Missing categories for 2009, so perhaps we will see a decrease in activity in these categories.

The two categories that involve aggressive intent, Stolen and Hacker, were in the top three of most breach incidents and most breached records. The Hacker category had the largest number of records compromised for four of the five years.

The category which involved the highest immediate risk and consequences, Insider, had the fewest number of incidents. It also had the lowest number of records compromised for four of the five years.

The total number of breached records for each category fluctuated from year to year. Also, the total number of records for all categories fluctuated from year to year.

There is no causal relationship between the total number of breach incidents per year and the total number of records compromised per year. In 2005, 54 incidents caused 1,837,826 records to be breached. In 2006, the same number of incidents caused the breach of 2,017,639 records. Yet, in 2007, 63 incidents caused a much smaller number of records to be breached, 732,372. Then, in 2008, in the final full year, 71 incidents caused 5,354,161 records to be breached.

There was no causal relationship between the total number of incidents per category and the total records breached per category. The Hacker category had the largest number of breach incidents, but had the second largest number of breached records. The Stolen category had the highest number of records compromised, but the third highest number of incidents.

The year 2007 should be investigated to find out why there was a low percentage of breached records. When compared to 2009, 2007 is likely to have the lowest percentage, since the first part of 2009 has 5% breached records.

Universities remain extremely vulnerable to breached records as the number of incidents of breached data has not been steadily decreasing. In addition, the number of universities with repeat incidents indicates that more should be done to prevent data breaches. Are we not learning from experience? Even allowing for the increased knowledge of those with malicious intent, the fact that the second highest number of incidents is in the Exposed category highlights the need for continued vigilance. Records breached through Exposure are most often attributable to mistakes and negligence. In addition, though incidents of breached data have received increasing publicity since 2005, 47 of the 152 universities have had multiple incidents and eleven have had at least five incidents.

In this environment of shrinking budgets, universities must recognize the need for Information Technology staff with specialized security knowledge and provide computer security training to faculty, staff, and students.

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# **A PHILOSOPHICAL AND ETHICAL STUDY OF GOOD AND EVIL APPLIED TO BUSINESS**

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## **ABSTRACT**

We argue that philosophical study of good and evil may be profitably applied to contemporary business practices. We review theories of good and evil, drawing upon both sacred and secular texts and ranging from the Book of Genesis to Leibniz to Nietzsche. We identify several basic themes in this literature, and then consider current business practices in those terms. The result, we find, is a useful terminology for understanding the commercial world we live in.

## **INTRODUCTION**

The concept for this interdisciplinary paper came from several intersecting events. First, the son of a social science professor announced that he wanted to major in business. His mother's reaction was similar to a child announcing that he wished to become a Nazi prison guard – oh the expression of dismay that her son would become a filthy capitalist! At the same time, a philosophy professor was developing a special course, “The Philosophy of Good and Evil,” using both religious and secular texts to examine the underpinnings of good and evil and whether they can exist along side one another. The topic became even more germane with the financial crisis which started in 2008, and continued with news stories about people greedily seeking wealth in the business sector, but being the victim of their own greed in cases such as that of Bernard Madoff. Hence, we came to consider whether the philosophical discussion of good and evil might usefully illuminate our understanding of contemporary business practices. Obviously, there is a good aspect since businesses provide for our basic needs through the manufacture, distribution, and sale of clothing and food and the provision of shelter and healthcare. In addition to having basic needs met, any reader of this paper likely has many of his or her “wants” or higher level needs met through the global commerce system. However, on a daily basis the



media carries stories of evil that exists in business, such as the lack of child labor laws in some countries or a lack of enforcement in others, as well as other issues related to worker safety, or products being sold with no concern for the health and safety of the consumer, with examples in our lifetime from the Ford Pinto in the 1970's to the 2009 peanut butter contamination.

Describing business practices in terms of good and evil may seem hyperbolic, or likely to produce only platitudes. We find, however, that attention to the logic of these ideas provides clarity and detail in such talk. Mazar, et al have recognized the good and evil, as defined by honesty and dishonesty, in human behavior. [4] They conducted six independent experiments using college students to test why people are dishonest. They found that many will be dishonest enough to gain from a situation, but only to the extent that it does not violate their personal sense of integrity. Ariely commented further on honesty in personal behavior. [1] He reported an experiment using 500 people, which found that once people cheated the first time, such as with a counterfeit fashion item, then the easier it was for them to cheat the next time.

Therefore, this discussion should be of interest to academics and business practitioners alike. The paper presents an overview of classic philosophical and literary perspectives on good and evil in three sections: Genesis and Milton on goodness and rules; Leibniz and Voltaire on idealism v. pragmatism; and then Nietzsche on rule-breaking and rule ambiguity. Each section presents the main, general ideas about good and evil as derived from these thinkers, and then the ideas are portrayed in business practices. Further examples of the ways good and evil co-exist in business are summarized in Table 1. These business examples and others in the paper have been widely publicized, so specific references are not provided.

## PHILOSOPHICAL DISCUSSION OF GOOD AND EVIL

### Creation and Fall: A Good Idea Spoiled

In Genesis 1-3, we find several basic ideas concerning goodness and evil. [3] The first is that of the priority of goodness with respect to evil. All that God makes is good, a paradise, a Garden. In particular, the sacred value of the earth, the heavens, living organisms, and humanity is asserted. Evil, by contrast, is secondary, an aberration. First there is the Garden and all of God's creation, which are good. Then come the snake, temptation, and the Fall. So we have this basic idea, that goodness is logically prior to evil, that evil is a perversion or disruption of a pre-existing good. Without the original good, there can be no evil, for there is nothing to be corrupted.

Second, we see in Genesis that God's creation is what the Ancient Greeks would call a *cosmos* – an ordered world. God replaces the “formless void” (1:2) with ordered being. The “separations” of heaven from earth, light from darkness, day from night, etc. impose fundamental, logical divisions where otherwise there is chaos – i.e., the lack of order. Humans, too, are part of the natural order; their place of “dominion” established by divine command. And human behavior is ordered as well. A single rule is made explicit: that Adam and Eve may eat from any but the tree of knowledge of good and evil. The ideas of order and goodness, furthermore, are clearly connected. The ordered garden is itself a good thing – a beautiful place of peace and plenty. Following the primary rule of the garden is also good, insofar as it implies understanding of the

concept of a rule, and that of “correct” (and hence good) versus “incorrect” conduct with respect to the rule. And further, the result of following the rule of the Garden is again good, the goodness of human life in a peaceful paradise.

Our first idea was that goodness is prior to evil, and our second basic idea concerning evil reiterates and elaborates this idea. Where our developed notion of goodness involves order and rules of conduct, the correlative notion of evil will again be parasitic on and corruptive of this prior order. This is the idea of evil as rule-violation. Where principles of order (rules) exist in order to create a good, ordered being, violation of these principles corrupts goodness, thereby producing or constituting evil. This idea is evident in the account of the Fall in Genesis 3. The single explicit rule of the garden, not to eat of the tree of knowledge of good and evil, is violated by Adam and Eve, resulting in their punishment, itself an evil: pain in childbirth and subservience for Eve, toil and anxiety for Adam.

Our Genesis text also provides this further, third idea: the Garden contains a snake. That is, while the Garden is intrinsically and wholly good, there exists within it, inexplicably, a source of evil. This evil takes the form of a serpent which tempts Eve to eat of the tree of knowledge of good and evil, precipitating the Fall. The presence of the serpent in the Garden goes unexplained, as does the capacity of Eve and Adam to disobey God’s command. Given the suggested perfection surrounding and embodying them, one might wonder on what basis either chose disobedience over obedience. But this, arguably, is precisely the knowledge that Adam and Eve lack, having not yet acquired knowledge of good and evil. In other words, while obeying God’s word may be judged “right” and “good”, neither Adam nor Eve would seem able to know it: they are innocents.

John Milton offers an explanation of the Fall in *Paradise Lost*. [5] The serpent is a creature of Lucifer, who himself has fallen and wages war upon heaven. Lucifer’s own fall is the product of pride, on Milton’s account:

... he of the first,  
If not the first Arch-Angel, great in Power,  
In favor and preeminence, yet fraught  
With envy against the Son of God, that day  
Honor’d by his great Father, and proclaim’d  
*Messiah* King anointed, could not bear  
Through pride that sight, and thought himself impair’d.  
Deep malice thence conceiving and disdain,  
... he resolv’d  
With all his Legions to dislodge, and leave  
Unworshipt, unobey’d the Throne supreme,  
Contemptuous, ...  
(V.659-671)

As in Genesis, Milton’s principal goods appear first to be God himself and all his products. And as in Genesis, obedience is a good, for Milton, and in particular, humility, the reverse of pride – i.e., a sense of one’s own limitations and a willingness to observe them. Pride brings about

Lucifer's fall, and he then tempts Eve to her own prideful fall. However, Eve is not without prior pride; she resists Adam's offer of protection, when the pair are informed of the presence of the serpent in the Garden, wishing to demonstrate her own strength and autonomy.

As in Genesis, we are left to wonder how pride emerges in an otherwise wholly good environment. Short of an explanation, however, we may take both accounts as descriptive of a fundamental human condition. While we may be well aware of the goodness that surrounds us and of the rightness of proper and humble conduct, we are nevertheless given to pride, to selfishness, to an elevated sense of our abilities, to the disregard of established law and the welfare of others. A number of parallels may now be drawn with our more particular behavior in the context of business practices good and evil.

In the beginning, there was a good idea: cooperative business exchange that would benefit both or all parties. The entrepreneur would offer a good or service to satisfy the needs or wants of the buyer. The seller or provider would use the profits to support his or her needs and wants. The price would be fair or mutually determined. In the US, a variety of rules and laws define good business practices to ensure that products are as advertised, produced in a way that is safe for the worker, environmentally considerate, and safe to the consumer. Violation of the rules and laws of good business result in corruption of good business, its products, and those it is intended to serve. The basic business evil, then, is corruption or disruption of the good business exchange. In some cases, this disruption is extensive. Our current fiscal crisis illustrates the kind of damage that business evil can wreak when there is a violation of the rules, whether they are regulations or rules of commonsense. The recent housing crisis provides multiple examples of what started as good becoming evil. Individuals being able to own their homes, build equity, and have investment in their community are good. But the falsification of records by builders, real estate appraisers and the real estate attorneys were themselves evil. Further evils then resulted when people who had bought homes they were not able to afford, lost the homes to foreclosure. They lost the modest funds they had invested, which in many cases represented their life savings, and found themselves homeless. The impact rippled though the communities, as these foreclosed and abandoned homes caused other homes in the neighborhoods to decrease in value. The greatest impact was on tax payers across the US, because these mortgages had been backed by the federal government.

A primary cause of business evil is what Milton identifies as pride: placing oneself above or beyond the reach of law, owing to an inflated or false sense of one's importance or abilities. We might accurately represent the Bernard Madoff scandal in these terms. The extent and audacity of the Madoff fraud is breathtaking, to say the least. One wonders how he thought he could get by with the fraud he perpetrated on investors who sought his advice. Many of the stories of this case emphasize that he did not seek investors, but rather, one had to know someone to get to him, such was the reputation he created. Many of those whom he was cheating thought of themselves as his friends, so that his pride may be said to have violated both moral and civil statute.

### **The Best of All Possible Worlds: A Golden Land of Opportunity**

A second set of basic ideas in the philosophy of good and evil involves a general intellectual tension obtaining between rational idealism, on the one hand, and a more pragmatic acceptance

of appearances, on the other. The general idea, here, is that humans seek naturally to discover a rationally intelligible structure in the world around us, but the appearance of rational structure is incomplete at best. Some philosophers maintain that such order as we perceive is indicative of a larger, comprehensive one, while others remain suspicious of such an ideal. Where the terms of the debate include good and evil, the distinction between these views can be striking.

Gottfried Wilhelm Leibniz was a 17<sup>th</sup> Century idealist philosopher working at the height of the Age of Reason. By his account, this is the “best of all possible worlds,” meaning that however otherwise it might appear to us, *nothing* could occur or be different to make the world a better place. [2] Every event, state, and object must be considered not simply good but the best possible – or, in any case, a necessary element in the best possible goodness. Evil, for Leibniz, is a manifestation of human ignorance: we are incapable of understanding the overall complexity of the world, so that certain goods escape our notice – i.e., those reconciling apparent evils. We may not have the intellectual power to comprehend all, but this is a quantitative problem, not a qualitative one.

We should emphasize, Leibniz’s view does make sense. Indeed, as we have seen, humans face a challenge in making rational sense of evil. For Leibniz, it makes no sense for an evil thing to exist or occur where a good one might otherwise have, for given a choice between the two, no rational creature would choose evil. Hence, the only things whose existence *can* make sense are good things. And so, if *everything* makes rational sense, then only good things exist – i.e., this is the best of all possible worlds. In other words, for Leibniz, either we believe that the world we live in ultimately does not make rational sense, or we believe that it is perfectly good.

As might be expected, Leibniz’s views did not lack for criticism. In his satire *Candide*, Voltaire portrayed Leibniz’s view as not simply obviously mistaken but offensive and pernicious. [7] The evils of the world are wholly and terribly real, for Voltaire. War, rape, disease, violence, insanity, treachery, etc. are all real features of our world, and it is an insult to such injuries to suggest that they are not truly evil. Voltaire would agree that we cannot make sense of the evils of the world, but rather than rejecting the appearance of the world as including evil, which is Leibniz’s response, he rejects the rationalist principle that motivates Leibniz’s view. The appropriate response to the evils of the world is not to construct an intellectual “otherworld” in which they are absent, but rather to attend to one’s own life and ambitions. “Cultivate your garden,” is Voltaire’s famous response to the intellectual problem of evil. Don’t look to the starry sky of idealism. Make the world around you as comfortable and pleasant as you can. So, rather than seeing the world as wholly and perfectly good (and rational), he sees it as it appears to us – as including some goods and some evils, and not making anything like complete, rational sense.

In other words, *Candide* may be read as a cautionary tale about exceeding one’s reach. Because we can think in universal terms, we are tempted to think of the world as a whole. Is it good, on the whole? Is it evil? Where do good and evil fit, in the grand scheme of things? Such thought leads to absurdities such as Leibniz’s view, according to Voltaire. We return, then, to the theme of pride and humility encountered above and the importance of recognizing human limitations. We are not, in fact, capable of understanding the entire universe; we do not even come close. And we live better lives under this realization, than without it.

Applying these ideas to the business world, we may contrast the idealism of, e.g., the free market and its invisible guiding hand, America as the golden land of economic opportunity where everyone has the opportunity to progress up the economic ladder and the expectation that everyone is playing fairly by the rules, with a more pragmatic approach built on the recognition that not everyone will behave. While we may all wish for – and some even believe in – an ideal world in which business practices are “self-correcting”, etc., the fact is that we don’t live in such a world, and that our efforts to regulate business practices reflect precisely this realization. The Leibniz/Voltaire issue concerns whether our world is perfect or not. While some economists and business leaders seem to think that this is a perfect business world, even if only potentially, the more pragmatically minded recognize that this is simply a nice idea, and that we must protect our commercial structures from the inevitable corruption, if they are to serve us well. That is, we may expect people to behave in the ways that are good but, like Voltaire, we must temper such expectations with prudence. Laws and regulations are passed after people have been caught at some evil act, and the laws are reactive to prevent future violations. The Securities and Exchange Commission (SEC) had complex regulations for the reporting of financial information to the government and shareholders. However, the Enron management team found clever ways to circumvent the reporting regulations by using special purpose entities (SPE), to not only hide losses, but to make it appear the company was profitable. Since the company appeared profitable, investors continued to buy the stock, including Enron employees who put all of their 401k investments into the company. When Enron declared bankruptcy, employees not only lost their jobs, but many of them lost all of their retirement savings. In addition, Arthur Andersen, one of the largest and most respected accounting firms in the country had been responsible for the audits of Enron, but with the scandal and trials associated with this case, they were forced out of business. To prevent this from happening again, Sarbanes-Oxley was passed to further refine the reporting and auditing requirements for publicly traded companies, including provisions for criminal prosecution for corporate officers, board members, and auditors found guilty of fraud.

### **The Law of the Jungle**

Finally, we turn to a view concerning the validity of our concepts of good and evil themselves. While writers such as Milton, Leibniz, and even Voltaire accept the objective reality of good and evil, Friedrich Nietzsche famously challenged this assumption. [6] He maintains that the designations *good* and *evil* reflect only the world-view of a particular people, and that the rules of conduct that they imply are, like all rules, made to be broken.

In general, for Nietzsche, life requires some relatively stable structure if it is to persist. Plants, for example, must develop and maintain stems, roots, and leaves of a certain, orderly sort if they are to flourish. Human life is no different in this respect, and is distinctive for its use of *reason*. Rational thought is a kind of organization defining our form of being. But in Nietzsche’s view, we shouldn’t mistake every element of our rational organization of the world for *truth*. It is primarily a system of order. Central to this system are *values* that determine standards of right conduct – rules for behavior, in other words. A glance at the world’s cultural history reveals different peoples, and their differences are defined by their beliefs and values – different forms of ordered human life. Further, we should note, the world’s cultures are not unchanging, but undergo gradual and sometimes sudden transformation over time. To the extent that a culture

can change with the times, it may preserve its essence. In the long run, however, even this essence will inevitably run its course. Thus, human culture involves cycles of development and subsequent destruction of organized social being. We construct rules for living and live accordingly until revolution brings about a new set of rules.

A number of key consequences for our concepts of good and evil may here be emphasized. First, there is the relativization of good and evil to a particular species – or race, or class, or culture, etc. Some things we can all agree to call good, such as food and shelter and relief from pain. But, given our competing interests, it is again another matter whether we might all agree whether the welfare of one group is good in the eyes of another.

Second, there is the ambiguous standing of the rule-breaker. A rule-breaker will always be evil in the eyes of the culture preserved by the given set of rules. But cultures evolve precisely by the violation of existing rules, so that the rule-breaker may later be perceived as the trend-setter, the innovator, the visionary, the martyr, etc. These ambiguities are readily apparent in our business world. For example, monopolies are considered bad in most cases and are illegal, yet patents create monopolies for periods of time to reward research and development. In effect, the patent gives the drug manufacturer a patent for a period of time to allow them to recover the significant cost involved in the research and development of new medications. Without this patent protection, which creates a monopoly, R&D would never be cost effective, and medical progress would be inhibited. For another kind of ambiguity, when considering the general welfare of large population versus the welfare of small groups, how does a drug manufacturer allocate its research investment? The profits made from the mass demand for one drug ( a general pain reliever) will generate the revenue for the R&D for a drug to treat a disease or condition in a small section of the population (rare cancer treatment).

### CONCLUSION

Genesis, Milton, and Nietzsche all construe good and evil specifically in terms of adherence to rules of behavior. Pride, in Genesis and in Milton, is the sin that encourages us to challenge external authority, to exceed our limits. For Nietzsche, these limits are self-imposed; they are merely orders of the day. Leibniz and Voltaire, too, can be read in these terms. Leibniz displays a form of pride in the human form – that our way of thought is representative of the cosmos, and that we are in principle capable of grasping its order. Voltaire attempts to demonstrate the error implicit in such a conceit.

Rogue business practices can be related to these works. Some corporate malfeasance seems to be built precisely on the disregard for rules and conceited vainglory that the above philosophers discuss. Given the difference among the writers, this paper can generate an interesting discussion of unfortunate business practices and better understanding of why they occur and how they can be prevented, or not prevented due to human nature. The following table summarizes our findings, offers further illustrations, and serves as the basis for oral presentation of these remarks.

<b>Phil. Source</b>	<b>Concept of Good</b>	<b>... in Business</b>	<b>... Illustration</b>
	<b>Concept of Evil</b>	<b>... in Business</b>	<b>... Illustration</b>
Genesis	Goodness is prior to evil.	That is, in the	Commerce itself, in all of its

	Goodness involves order, identified in terms of rules or laws.	beginning, there was a good idea: cooperative business exchange. Businesses help us lead better lives with the goods and services they provide. Rules and laws, both formal and informal, define good and fair business practices.	variety. The laws and customs of commercial enterprise and exchange. Selling an automobile. Buying tomatoes at an untended roadside stand.
	Evil is a corruption of goodness. Corruption of goodness involves violation of rules or laws specifying the good. The inclination to corruption seems to be intrinsic to the human condition.	Evil in business corrupts, disrupts ideal cooperative exchange. The rules of good and fair exchange are broken. Humans are readily tempted to violate the business trust.	Deceptive, unfair, false, business practice. Violation of trade laws, of contracts, of trust. Falsifying automobile history. Taking a tomato without paying.
Milton	Humility is a condition of preservation of the good – i.e., a willingness to submit to prevailing laws and customs defining human goodness.	Willingness to submit to prevailing laws and customs of commercial exchange.	Every law-abiding, fair-minded exchange of a good or service. Tylenol responded quickly and at great cost to the company to remove all products from the shelf after their famous tampering case.
	Pride goeth before a fall: placing oneself above or beyond the laws defining human goodness.	Flouting prevailing laws, customs, defining good and fair business exchange.	Enron leaders willfully deceiving investors and employees. The recent, knowing sale of salmonella-contaminated peanut butter. American cigarette manufactures' knowing promotion of a harmful product.
Leibniz	This is the best of all possible worlds.	Idealism: e.g., Adam Smith's invisible hand; America as the golden land of free enterprise and opportunity.	The recent "correction" of real-estate values. George Soros; Bill Gates.
	Evil is a mistaken perception obscuring our view of perfect goodness.	Apparent business evils obscure the reality of a good.	Charitable contributions improve public image but also benefit the community. Patents effect monopolies but reward R&D expense. Ford did not recall the Pinto after executives knew the risk of explosion and fire in a rear-end collision. The estimated cost

			of lawsuits from loss of life was less than the estimated cost of a recall.
Voltaire	Evil is real. Ignoring the existence of evil is wrong and dangerous.	Business evils are real. Ignoring them is wrong and dangerous.	Oversight, regulation, punishment of rule-violation, etc., are necessary to curb business evil. Current packaging standards for food and over-the-counter medications require extra tamper-proof requirements at extra costs, which are ultimately passed to the consumer. The Sarbane/Oxley bill tightened regulation in response to the Enron scandal. Regulation of lending practices will be stiffened in response to the recent banking crisis.
Nietzsche	The good is whatever contributes to the power of a thing, where power is defined in terms of the capacity to influence one's surroundings.	In general, what is good for a business is that its power in the marketplace increase. This power may coincide with or contribute to the power of the host community.	Where would the US be without the contributions of the automobile industry over the past 100 years? Alfred Sloan, former CEO of GM, "What's good for the country is good for General Motors, and what's good for General Motors is good for the country."
	(i) In power terms, the bad is simply whatever detracts from a beings power/capacity to influence the environment. Any entity that becomes too rigid or otherwise fails to keep up with the times is going to fall. (ii) As ordinarily used, 'evil' means "unholy" – really bad.	(i) Ultimate strength of a business may entail its own demise, especially as from the lack of a competitive environment, and the capacity to adapt to change. (ii) Are "predatory" business practices "evil" intrinsically, or only in the eye of the beholder?	(i) The very systems and patterns that were once its strength become the bonds preventing its reacting successfully to its environment, as with the current practices and products of GM. (ii) Negotiating the tension between the healthy capacity for growth and managing the costs to human individuals remains a challenge.

**TABLE 1. PHILOSOPHICAL CONCEPTS AND BUSINESS EXAMPLES**

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**A REVIEW OF IMPLEMENTING INTERNATIONAL  
FINANCIAL REPORTING STANDARDS IN TURKEY**

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## **A REVIEW OF IMPLEMENTING INTERNATIONAL FINANCIAL REPORTING STANDARDS IN TURKEY**

### **Abstract**

The implementation of International Financial Reporting Standards (IFRS) has been compulsory in the public companies in Turkey as of January 1<sup>st</sup> 2005 and the legal regulations for all of the companies will be completed in the near future. IFRS requests the business managers and accountants to make a decision/choice according to their judgements in many ways. In Turkey, European accounting culture and practices is dominant. This cultural difference is the main reason for the problems in implementing IFRS in Turkey. Since tax-based book-keeping is common in Turkey, it is possible that accounting professionals are influenced from judgement generating process when they use their professional judgements. This study provides a review of some of the issues in implementing IFRS and what needs to be done.

## **A REVIEW OF IMPLEMENTING INTERNATIONAL FINANCIAL REPORTING STANDARDS IN TURKEY**

### **1. INTRODUCTION**

The headquarters and other units of a business may be established in different countries in today's global trade/commerce environment. Thus, financial reporting and transfer problems could occur between the main country and the other country(ies) and there could be huge costs as a result of these problems. Besides, it could take a long time to provide adaptation to the accounting system of the country where the investment has been made. The term 'Convergence' has been brought up for the solution of all these problems. The above mentioned problem (convergence) is usually removed when certain arrangements, such as IFRS, are implemented and are put into force all over the world (Mugan and Akman, 2005).

The countries accepting IFRS have different cultures and so they have different accounting practices and implementations (Hofsted, 1983). This difference between the countries causes new various issues in implementing IFRS. Accounting culture of the countries shows itself when professional judgements are used for various purposes. Businesses must use general and accounting policies, choices, estimations and their own values during the implementation of IFRS. This is usually the result expected from the principal based structure of IFRS.

The usage format of the professional judgement plays an effective role in implementing IFRS in a proper way. This paper studies the potential role of the implementation of IFRS within the framework of the professional judgement usage models in Turkey and the issues related to it.. The next section provides a review of the international financial reporting standards in Turkey, section three describes "professional judgement", section four presents the role of professional judgements in implementation fo international financial reporting systems in Turkey and section five provides

conclusions.

## **2. INTERNATIONAL FINANCIAL REPORTING STANDARDS IN TURKEY**

Implementation of IFRS was on a volunteer basis until 2005. However, as of January 1, 2005, public companies are obliged to implement IFRS according to the European Community membership studies. New Turkish Trade Law Draft which has been negotiated/discussed at Turkish Grand Assembly rules that the financial reports of the companies should comply with IFRS. So, all of the companies will have to prepare financial reports in accordance with IFRS.

Turkish Accounting Standards Board have translated the standards of IASB and published Turkish Financial Reporting Standards and put them into force for the convergence purpose. Convergence processes are still being carried out in many countries and establishments all over the world. Of course, these processes cause some problems that may be listed as follows ( Zeff, 2007, 296 ):

- 1- problems due to comment,
- 2- language problems,
- 3- problems in technical terms ( terminology problem ),
- 4- problems related to the change of profit measurements,
- 5- the role of the capital markets,
- 6- political effects.

It can be said ‘problems about comment’ will be mostly in implementing IFRS in Turkey. It is necessary to understand the spirit of the standards rather than its meaning ( Mason and Gibbins, 1991, 24 ). The spirit of the standards comes from Anglo-Saxon culture. Therefore, there will be a difference between the comment of an accountant coming from within this culture and an accountant coming from out of the Anglo-Saxon culture. Although the necessity of the standards are accepted

by all parties in the scientific studies about IFRS in Turkey, many of the problems have been emphasized to occur during implementation. The reason for these problems is that the accounting culture in which IFRS was born is different from the accounting culture in Turkey. The main problem in implementing IFRS is the habit of tax-based book-keeping for tax regulations (Mugan and Akman, 2007).

IFRS is a product of Anglo-Saxon culture and it includes the characteristics of this culture (Karabınar, 2006). The characteristics of the accounting implementations of the countries where Anglo-Saxon culture is dominant (for ex. USA, England, Holland ) can be listed as follows (Choi and Meek, 2008, p: 43):

- a) The terms ‘transparency’, ‘presentation suitable to the truth’ and ‘full definition’ are determinative in the accounting implementations.
- b) General accounting is essential in those countries and it has differences from tax accounting.
- c) Financial sources for businesses of those countries are provided from the capital markets and the aim of financial reporting is to submit information to the investors.
- d) Institutions preparing accounting and financial reporting standards are interested in private sector activities.
- e) Accounting profession and its representatives play an important role in preparing the standards and implementing them. The countries of Anglo-Saxon culture have rich comments about accounting and financial reporting implementations and their accounting and financial reporting rules are developed independently from their legal system. Regulations about the accounting system are prepared and conducted by independent Professional institutions and organizations (Alexander et al., 2007, p. 28).

In Turkey, European legal system and accounting culture depending on this system is developed (Demir, 2009, p. 82). Accounting implementations based on this system are valid in many European countries such as Germany and Sweden and in the old colonies of those countries in Africa, Asia and America continents. General characteristics of accounting implementations in the countries' legal system depending on the acts dominant is as follows (Choi and Meek, 2008, 43):

- a. Accounting has been formed with insufficient and non-transparent definitions within the legal regulations.
- b. Practices of financial accounting and tax-aimed accounting are very close to each other and tax-based accounting is dominant.
- c. Financial sources of the businesses are generally banks and governments.
- d. Financial reports aim at keeping the rights of the creditors.
- e. Institutions preparing accounting and financial reporting standards are usually interested in public sector activities and accounting professionals and their organizations have very little effect in preparing the standards (Alexander and others, 2007, 28 ).

Laws arranging daily life (including accounting and financial reporting practices ) in the countries which implement this system are regulated to take care of all the details. Therefore, the rate of using professional judgement by accountants and auditors in the accounting practices is very low (Deegan and Unerman, 2006, p, 100 ). The current situation of the accounting culture and accounting values in Turkey can be summarized as follows:

- In Turkey, there is an accounting culture that is standard, secrecy based, conservative but open to flexibility, accepting compliance with the laws and requesting professionalism (Karabınar, 2007).

- Since accounting in Turkey is from a different culture group and its values are different (Karabınar, 2005), and tax and the other legal regulations are determinative, it can be said that the comments of Turkish accountants will be far from those of Anglo-Saxon groups and therefore from IFRS spirit. This is also the most important problem for implementing IFRS in Turkey. When accounting and tax practices are studied in Turkey, this case can be shown as one of the basic reasons for not having been able to develop national accounting standards up to now (Demir, 2009, p. 87). Tax practices are under heavy effects of mainly Tax Law and other Tax Laws (Mugan and Akman, 2007).
- To set up a different standard is, at first, the function of public institutions and disclosure of information to the public opinion and demand for high quality financial reports is lower in these countries. On the contrary, high quality standards are considered to be a necessary vehicle to protect investors' rights (Mugan and Akman, 2007 ).

### **3. WHAT IS A PROFESSIONAL JUDGEMENT**

Two accountants performing a similar job can comment the same event in different meanings under the same conditions. The factors causing the difference are the social values, such as culture, life, religion, economy and politics. According to a definition in the accounting literature, professional judgement can be defined as making a choice by using skill, knowledge and experience which the profession requires when it is necessary to make a decision and choice among the alternatives. There are two significant points in this definition. These are the necessary and sufficient knowledge/experience and making a choice among the alternatives. The said knowledge is the accounting knowledge. Making choice is to choose one of the methods which accounting and auditing requires (Dalkılıç, 2008, p. 64).



The process to reach the judgement is a complex process which includes the steps, such as comprehension, defining the subject, collecting the necessary information, defining the conclusions and evaluating the results based on the possible decisions (Dalkılıç, 2008, p. 62).

There is a trend in accounting as ‘bad judgement drives away good judgement’. A judgement considered to be perfect about a given case can be used in the same way for a similar but different featured case referring to the previous one. The continuity of this misleading can be wrong for the current case but can have a reference related with the previous one (Dalkılıç, 2008, p. 71). Because of the understanding that tax-aimed accounting tradition settled in Turkey, it is strongly possible that there will be tax related judgements as a result of previous experiences and events.

There is a strong relation between the professional judgement and ethics and habits. The process of forming professional judgement can be effected from traditions, religion, philosophic systems, cultural experiences, legal system and ethics (Hartman, 2002). The amount of an accountant’s professional experience can be important. While an inexperienced accountant is inspired by what he/she has studied as the judgement process, an experienced accountant will be inspired by the experiences and events he/she had in the past.

#### **4. THE ROLE OF PROFESSIONAL JUDGEMENTS IN IMPLEMENTATION OF INTERNATIONAL FINANCIAL REPORTING STANDARDS**

Each standard is a ‘collective judgement’ of a group of persons who have prepared those standards. What must be questioned is when the collective judgement must take place in the standard (Dalkılıç, 2008, p. 74).

The relation between the standard and judgement is usually not clear and precise since professional judgements and standards are the products of mankind and they are never perfect

(Dalkılıç, 2008, p. 77). In general, the standards do not indicate the situations which require the use of judgement clearly. They want the management to determine its judgements (Mugan and Akman, 2009). So, the use of judgement will be of a great meaning during an application of a standard. Because, to have a weak and incomplete judgement about the standard will not provide the expected result and will cause a lower quality financial report at the end.

Accounting profession could not reach the target of ‘information-aimed accounting’ under the stress of the tax applications for too long although universities in Turkey have tried a lot in the past. So, accounting professionals could not ignore the rules pointed out in tax regulations in their professional activities which prevented the accounting professional in Turkey from developing their “professional judgements” (Demir, 2009, p. 13).

Professional judgement is a necessary, required and unavoidable fact. The problems that could be faced in the quality of professional judgement are as follows (Skinner, 2001 );

- 1- Professional judgement may be used in an inappropriate way,
- 2- Accounting theory (or conceptual frame) may not be clear enough to lead to professional judgement,
- 3- Accounting standards can have a lot of alternatives and can sometimes be incomplete and unclear from the point of definitions.

‘Ethics’ concept, which is important under every condition in accounting world, has a different role under the principle-based standards, that is when professional judgement is dominant. During the process of forming professional judgement, accounting professional may have to make decisions based on their own “conscience” (Dalkılıç, 2008, p. 107).

IFRS’s require the use of estimations, comments and judgements prepared by business managers and financial analysts. The points for which professional judgement is used during the

application of accounting standards are listed as follows (Mason and Gibbins, 1991);

- 1- Direct use of judgement may have been written in the standard text.
- 2- The use of professional judgement while choosing one from the alternatives
- 3- The use of professional judgement about appropriateness of a method,
- 4- The use of professional judgement for the understanding of a written text: The understanding of the sentence is left to the person's professional experience and judgement through sentences which are open to comment.
- 5- The use of judgement about the standards whether it needs judgement or not: for example; when some calculations are required without any formula, judgement will be used mostly.

In a recent study (Dalkılıç, 2008), nine standards are selected and Mason and Gibbins' model was applied to these standards. The standards used in this study and the number of cases which require professional judgement are as follows (Dalkılıç, 2008, p. 165):

<b>Standards Used</b>	<b>Number of Professional Judgements</b>
Standard of Inventories	13
Standard of Cash-Flow Charts	5
Standard of Tangible Assets	15
Standard of Lease	8
Standard of Revenue	10
Standard of Borrowing Costs	4
Standard of Depreciation of Assets	9
Standard of Returns, Contingency, Debts and Assets	35
Standard of Intangible Assets	12
<b>TOTAL</b>	<b>111</b>

While producing judgement for the subjects which require judgement, accounting professionals in Turkey will produce judgement about tax and the other legal arrangements related with the above Table. Somehow, this situation will cause serious dangers in providing true and

useful information to the financial table users and producing high quality financial reports for IFRS. This case is valid not only for Turkey but also for countries like that are similar to Turkey.

## **5. CONCLUSIONS**

Professional judgement is effected by many societal values of the person who produces judgement, such as the professional experience, political and economical tendency, religion, culture, etc. Therefore, professional judgement is a subjective process. IFRS's request business managers and accountants to make a choice according to their own judgements. European accounting culture is dominant in Turkey. This cultural difference is the first point to cause problems in implementing IFRS in Turkey. Since tax-aimed book-keeping is common in Turkey, accounting professionals' judgement producing process will be realized from the point of taxation because of the previous experiences. However, tax-aimed professional judgements will not achieve producing high quality financial reports which shows the real situation of the business. There are almost no empirical studies on professional judgements in implementing IFRS's which makes it impossible to compare implementation issues in different countries.

It is unavoidable that the present accounting culture must change in order to obtain developments for the objectives and targets of IFRS applications in Turkey. With a tax-aimed accounting culture, an accounting atmosphere will not arise since the businesses and accountants should use their own judgement where and when necessary. In order to solve this problem, it is compulsory to explain the spirit of the standards quite well. There is a need to develop empirical studies for finding out more about the IFRS implementation issues and concerns in the public companies in Turkey. Those studies should be analyzed and studied carefully and thoroughly to assist in the implementation of IFRS's.

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# ACCOUNTING CULTURE IN TURKEY

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## ABSTRACT

Gray (1988) proposed a framework for a theory of cultural relevance in accounting derived from Hofstede's Cultural dimensions. This is a pioneering study that focuses on culture-related studies in international accounting. To date, much of the literature in this area has been theoretical or subjectively described because the elements constituting Gray's framework lack an operational foundation. This paper presents research that empirically tested usefulness of Gray's accounting values in Turkey. The data are subjected to reliability analysis, factor analysis and frequency analysis, and the results provide some support for the usefulness of Gray's accounting values as empirically based classificatory constructs and results similar to the Chanchani and Willett's (2004). In this study, eight factors are extracted in factor analysis where uniformity and statutory values are the most clearly defined. According to the results of factor analysis, we may name the situation of Turkey's accounting culture as "*professionalism and uniformity*". The other dimensions of Gray's accounting values are diffused to each other in Turkey. This study concludes that, accounting culture in Turkey tends to use uniform practices that must outline professional judgements and regulations.

**Keywords:**Culture, Gray Theory, Accounting Values, Turkey, Accounting Culture, Turkish Top-500 Enterprises

## **INTRODUCTION**

### **THE RELATION BETWEEN CULTURE AND ACCOUNTING**

There are so many factors that affect accounting practises in a society. The nature of organization of the profession, regulatory institutions, economical factors, volume of foreign trade, culture of the society that live in, and structure of enterprises management are the factors that form the accounting climate in a society. Culture has the most significant and deepest affect among these factors. Many studies attempted to explore cultural dimensions (Hofstede 1983, 1997, 2001, Triandis 1994, Trompenaars, 1993). Gray (1988) identified four subcultural dimensions in accounting and named them "accounting values". But Gray's study was theoretical, not empirical. In this study, a questionnaire that designed by Chanchani and Willet was used. The questionnaire was sent to Turkey's Top-500 Industrial Enterprises which have big impact on the Turkish Economy. Therefore, companies in this study represent an excellent sample of Turkey's accounting climate. This study utilized the framework proposed by Gray (1988) to empirically test accounting values in Turkey.

### **LITERATURE IN ACCOUNTING CULTURE**

Scientific studies about accounting culture date back to the 1960s (see, for example, Bedford, 1966; Mueller, 1968; and Seidler, 1969). These early studies did not explain that how culture affects accounting (Doupnik, 2004). Harrison and McKinnon [1986] developed a framework that explains how changes in a country's financial reporting system occur. In a social system, changes in the accounting system affect four major groups: intrusive events, intra-system activity, trans-system activity, and the cultural environment. According to previous studies, changes to the accounting system are the results of both the intrusion of events and the interaction between the accounting system and neighboring social systems within the country. Culture affects the change process in two ways: by influencing the norms and values of the accounting system and the other social systems with which it interacts, and by influencing the behavior of groups in their interactions within and across systems. Doupnik and Salter (1995) expanded Harrison and McKinnon's framework (1986) to develop a general model of an accounting development. Cultural norms and values are seen as influencing accounting practices through norms and values held by members of the accounting system and other systems that interact with the accounting system (i.e., the institutional structure). The authors argued that these factors and values differ across countries.

Harrison and McKinnon (1986), Doupnik and Salter (1995), and Nobes (1998) provide theoretical frameworks that attempt to explain the process by which culture in general affects accounting. However, none of these authors models can be used to develop specific hypotheses as to how countries' accounting systems or aspects of those systems might differ because of differences in culture (Doupnik, 2004).

#### **Hofstede's framework about culture**

Culture is the independent variable in empirical researches investigates that the relationship between culture and accounting, The Hofstede's (1980) framework is one of the most widely used frameworks in accounting research. Hofstede has four components for the formation of and stabilizing of societal culture: outside influences, ecological factors, societal norms, and institutional consequences. Societal values affect the structure and functioning of a society's



institutions such as family patterns, social stratification, education, and political structure. These societal values are: Individualism, Power Distance, Uncertainty Avoidance, and Masculinity. Hofstede suggests that there are specific relationships between these societal value, and cultural dimensions. Hofstede's research on culture represents the most extensive research on national cultural differences. These four dimensions are shortly explained below.

- 1. Individualism Versus Collectivism**
- 2. Large Power Distance Versus Narrow Power Distance**
- 3. Uncertainty Avoidance Versus Not-avoidance**
- 4. Masculinity Versus Femininity**

These dimensions identify the main values that attempt to explain the general similarities and differences among cultures around the world. On the other hand, while empirical validation of these dimensions is far from complete, the dimensions provide explicit constructs that accountants and others can benefit from when considering the impact of culture on accounting systems and practices.

Hofstede identifies nine distinct cultural areas in which countries have a similar pattern of scores on the four cultural dimensions. These areas are

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. Anglo Countries                | 5. Nordic Countries               |
| 2. Germanic Countries             | 6. More developed Latin Countries |
| 3. Less developed Latin Countries | 7. Asian-Colonial Countries       |
| 4. Near Eastern Countries         | 8. Japan                          |
|                                   | 9. African Countries              |

Hofstede and Bond (1988) added a fifth cultural dimension, Confucian Dynamism, which was later renamed as Long-term Orientation. Hofstede (2001, p. 359) provides a short definition of this dimension: "Long Term Orientation refers for the fostering of virtue oriented towards future rewards, in particular, perseverance and thrift. Its opposite pole, Short Term Orientation, stands for the fostering of values related to the past and present, in particular, respect for tradition, preservation of 'face' and fulfilling social obligations." This dimension was originally developed through the use of a Chinese Value Survey and may capture differences in value preferences between Western and Eastern cultures.

### **Gray's culture related framework**

Gray (1988) identified four accounting values that can be used to define a country's accounting subculture: Professionalism, Uniformity, Conservatism, and secrecy. Gray (1988, p. 8) described these accounting subculture values as "accounting values":

- 1. Professionalism versus Statutory Control**
- 2. Uniformity versus Flexibility**
- 3. Conservatism versus Optimism**
- 4. Secrecy versus Transparency**

## **Empirical tests of Gray's framework**

A number of studies empirically tested one or more aspects of the theoretical framework proposed by Gray. Most of these studies attempted testing Gray's hypotheses using countries as the unit of analysis by examining relationships among Hofstede's cultural dimensions. In addition, five studies examined Gray's hypotheses using individual accountants as the unit of analysis. These studies focused on the relationships between cultural dimensions and accountants' attitudes and beliefs. These two different types of study are reviewed below.

### **Empirical tests of the framework at the country level**

Eddie (1990) provided the first empirical test of Gray's framework, testing all four of Gray's hypotheses. Eddie (1990) used an eclectic approach to construct indices of the accounting subculture values for thirteen countries in the Asia-Pacific region. He selected ten factors to measure each accounting value. He then scored each factor on a six-point scale and summed the scores to develop an index for each value. The accounting value indices were then correlated with Hofstede's cultural dimension indices for the 13 countries. In all cases, the predicted signs of association were confirmed. Salter and Niswander (1995) used regression analysis to test Gray's hypotheses with measures of accounting system attributes as the dependent variables and Hofstede's cultural dimension indices serving as the independent variables. Similar to Eddie (1990), Salter and Niswander (1995) used an eclectic approach to measure the dependent variables, with more than one measure developed for each value.

Salter and Niswander (1995) also tested the relationship between two institutional consequences, the level of market capitalization and the marginal tax rate, and the various dependent variables. Their method did not allow any conclusions to be drawn about the impact of these institutional consequences on the values shared by members of the accounting subculture.

Sudarwan and Fogarty (1996) employed a longitudinal approach focusing on a single country rather than the Gray's. They examined the relationships among the cultural characteristics of Indonesian society, reporting practices of Indonesian firms, and accounting standards promulgated by the Association of Indonesian Accountants. They hypothesized that, if culture and accounting are related, then changes in cultural dimensions should be related to changes in accounting values over time. Sudarwan and Fogarty (1996) developed their own measures of five cultural values between 1981 and 1992. This is the only study testing Gray that measured cultural values independently rather than using Hofstede's. It is also the only study to incorporate the fifth cultural dimension-Long-term Orientation- in the analysis. Each cultural value is substituted by multiple variables which are lacking an intuitive appeal. Sudarwan and Fogarty (1996) used structural equation modeling (SEM) to analyze the hypothesized relationships. Changes in three of Hofstede's cultural dimensions from 1981 to 1992 have significant relationships with changes in one or more accounting values; there is no significant relationship between the change in Masculinity and any of the accounting values. The results for Individualism are consistent with Gray's expectations for Professionalism only, and the results for Power Distance support the hypothesized relationship for Uniformity only. The results related to Uncertainty Avoidance support Gray's expectations with regard to Uniformity and Conservatism, but not Professionalism and secrecy. The Uncertainty Avoidance results are the only results that support Gray's

hypotheses that are common to both Salter and Niswander (1995) and Sudarwan and Fogarty (1996).

A fertile and perhaps more interesting avenue of research opened up when Douppnik (2004) refined the framework to describe how culture might affect the manner in which accountants apply the rules that are a part of financial reporting systems. The use of the experimental method to test the Societal Values, Accounting Values and Accounting Applications linkage will help in assessing the cause and effect relationship between culture and accountants' application of financial reporting rules, which in turn will help in determining the extent to which culture acts as an obstacle to the comparability of financial statements across countries. The increasing trend towards economic globalization makes the important issue of cross-national comparability more important than ever.

## **Research on the accounting culture of top-500 firms in Turkey**

### **Method**

The questionnaire items used in this study was designed by Chanchani and Willett. The items in Chanchani and Willett's questionnaire are applicable all over the World. Thus, they can also be used in Turkey. A copy of the questionnaire instrument is in Appendix A. The questionnaire was sent to respondents listed in ISO Top 500 Enterprises. We did not attempt to provide additional context to the questionnaire, such as whether the items are related to public or private companies. The questionnaire was designed to give a comprehensive coverage of accounting aspects.

### **Secrecy versus Transparency**

The secrecy construct is represented by questionnaire Items 4, 8, 12, and 16. All 4 items were classified as being related to financial statements disclosure. Item 4 was designed to capture the "external spread of user" aspect of secrecy noted in Baydoun and Willett (1995). Item 8 was aimed capture "information quantity" aspect of secrecy. Item 12 required respondents to indicate their agreement to the statement that information about management and owners should not be included in financial statements. Item 8 and Item 11 are relate to the information quantity and level of detail aspect of secrecy, with agreement to the item indicating higher secrecy. Item 16 was intended to capture the aspects of secrecy relating to managerial intentions. Items 4 and 16 are both relate to a transparency aspect of secrecy.

### **Conservatism versus Optimism**

Items 1, 6, 10, and 14 aimed to capture conservatism. Items 1 and 14 are relate to measurement and Items 6 and 10 realte to disclosure.

### **Uniformity versus Flexibility**

Items 2,3, 7, 11, and 15 are relate to the uniformity. Items 2, 3 and 11 intended to the measurement dimension, Items 7 and 15 to the disclosure dimension. Item two required respondents to indicate their level of uniformity by providing a specific measurement context. Externally set depreciation rates indicates higher uniformity.

## Professionalism versus Statutory Control

Items 5, 9, 13, and 17 relate to professionalism. The classification of all these items also relate to the social dimension of accounting, are consistent with the theoretical literature and the interpretation given to this value in previous research. In general, this construct refers to the attributes of those who perform the accounting function rather than the characteristics of financial statements.

Item 5 is a general and direct regulatory framework question asking if the accounting profession should be self-regulated. This is consistent with Gray's suggestion that professionalism is correlated with selfregulation and firmly established professional associations.

### PILOT TEST

In a pilot study of the questionnaire was sent to some accountants and accounting academicians in Turkey. To prevent the misunderstanding while translate into Turkish was used to reverse-translation method. Some objections about item 2 (in orginally) were separated into two question. So total questions were sum up to 17. The most important critics about the questionair about respondents.

### SAMPLE

The sample of this study consisted of preparers of financial statements in Top-500 Industrial Enterprises in Turkey. The reason for choosing these enterprises is indicator of overall scenery of Turkish accounting culture. Because Top-500 Enterprises has a large position in Turkey's Economy. Respondents are selected ramdonly. 200 questionair returned.

### RESULTS

This survey analyzed by meanns of reliability analysisi and factor analysis. In this section, the result of this method are reprinted.

#### a. Reliability analysis

Reliabilty analysis is based on Cronbach-alpha. In table-1, first column displays the name of accounting values, second column displays the list of items of accounting values. The third column display the scores.

Table-1: Reliability Analysis

Accounting Values	Items	Scores
Unifomity	2,3,7,11,15	0,48
Statutory	5,9,13,17	0,57
Secrecy	4,8,12,16	0,25
Conservatism	1,6,10,14	0,20

The 0,25 and 0,20 scores are the moot point of this study but may nevertheles provide a usefull tool about general outlook.

#### b. Factor analysis

Theoritically if Gray's framework is correct and if this survey have been desinged accurately, the factor analysis reveal eight factors, each loading factor contains the items associate with accounting values. Principle component analysis method used as extraction methods and *varimax* rotation method applied to all data. K-M-O scores extracted as 0,560. The eight factors totally explained %69,4. The first factors explained %10,6, the second factors explained %10,3, The third factors explained %8,7, The fourth factors explained %8,6, The fifth factors explained %8,4, The sixth factors explained %7,9, The seveth factors explained

%7,4, and finally The eighth factors explained %7,2. Table-2 displays the factor analysis results.

Table-2 The Factor Analysis Results.

ITEMS	COMPONENTS							
	1	2	3	4	5	6	7	8
2	-,790							
3.	,667							
13		,854						
9		,849						
15			,803					
16			,705					
10				,788				
6				-,755				
12					,815			
8					,695			
11						,746		
7						,622		
1						-,581		
4							,888	
5							,491	
17								-,749
14								,476

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.*

Factor-1, contains items 2 and 3 which related to uniformity. This factor attracts only uniformity

Factor-2, contains items 13 and 9 which related to statutory. This factor attracts only statutory.

Factor-3, contains items 15 and 16 which regularly related to uniformity and secrecy. This factor attracts both uniformity and secrecy.

Factor-4, contains items 10 and 6 which related to conservatism. This factor attracts only conservatism.

Factor-5, contains items 12 and 8 which related to secrecy. This factor attracts only secrecy.

Factor-6, contains items 11, 7 and 1 which the first two of three are related to uniformity and the rest related to conservatism. This factor attracts both uniformity and conservatism.

Factor-7, contains items 4 and 5 which regularly related to secrecy and statutory. This factor attracts both secrecy and statutory.

Factor-8, contains items 17 and 14 which regularly related to statutory and conservatism. This factor attracts both statutory and conservatism.

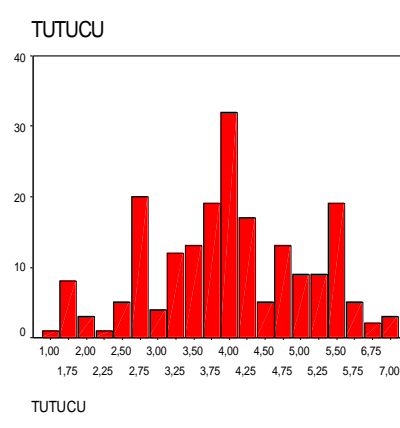
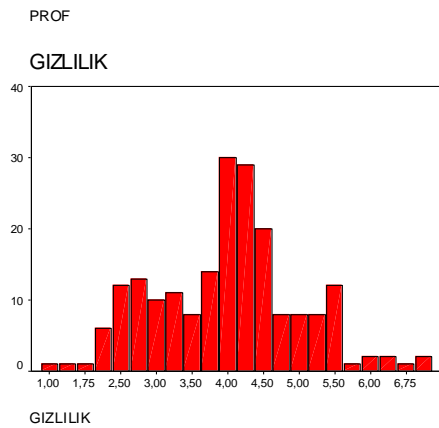
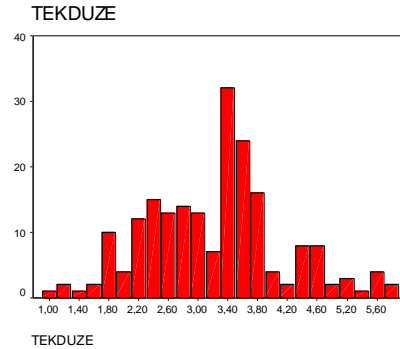
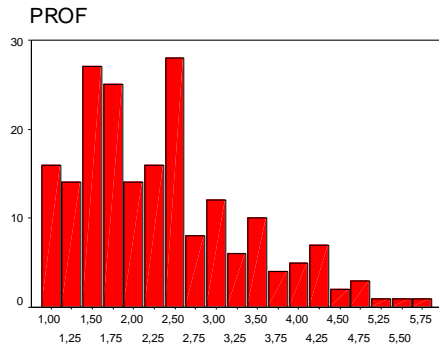
Except the factor 1 and 2, all the others mixed another accounting values. Factor 1 and 2 contains unique accounting value. Factor-1 consist of uniformity, and the second statutory.

Factor analysis results are similar to the results of Chanchani and Willett (2004). Chanchani and Willett extract six factors, first two factor of these are highly similar our results. In our study, Factor-1 contains uniformity items. So that we named it uniformity like the Chanchani

and Willett's. Factor-2 contains statutory items similar to Chanchani and Willett named it as professionalism

**c. Frequency Analysis**

By using the frequency analysis it is aimed to capture the clear view about the loadings factor. Here the frequency analysis results and graphics.



## CONCLUSIONS AND LIMITATIONS

This paper reports attempt to operationalize and empirically measure Gray's accounting values in Top-500 Industrial Enterprises of Turkey. Gray's accounting value constructs were operationalized as 17 items in an accounting value survey questionnaire on the basis of theoretical considerations, with four items representing each of Gray's four accounting values. The questionnaire was used to survey in preparers of financial statements in Top-500 Turkish Enterprises. The responses to the survey were analyzed using the reliability, factor, frequency analyses. Professionalism emerges most clearly as a coherent operational accounting value construct. The elements of the uniformity tends to uniformity. The secrecy and uniformity constructs also emerged, although less strongly than in the case of professionalism. They are spreaded on the scale. Conservatism construct tends to flexibility. The reliability scores were lower than would have been hoped. The factor analysis did not produce four factors, it revealed eight factors. The factor analysis reported in the paper explains about 69,4% of the variation in the data. According to the loadings of Factors I and II; Turkey's accounting climate can be describe as uniformity (factor-I) and describes as professionalism. This study, as with most factor analysis, is open to the criticism that others interpreting the factor analysis results might assign different labels to factors or interpret factor loadings differently. The labeling of the factors has been guided by the literature relating to the Hofstede–Gray framework, results from reliability and factor analyses. This study raises a number of new and interesting questions concerning the identity and nature of accounting's cultural dimensions that would not necessarily be so clearly identified by other more qualitative approaches to the subject. The Chanchani and Willet's AVS needs to be developed to address the limitations and weaknesses of design noted here and to be applied across different countries and samples of users and preparers. Such studies would contribute to the development of a repository of accounting values data for research and would help to address the current problems of lack of data associated with researching the cultural relevance hypothesis. This study aimed to provide primary data on an issue about which there is little empirical evidence.

## APPENDIX A. THE AVS QUESTIONNAIRE

	1	2	3	4	5	6	7
1. Profits and assets should be valued downwards in case of doubt.							
2 Depreciation rules should be set externally, specifically for separate groups of assets by Turkey's Capital Market and Financial Ministry							
3 Depreciation rules should be set externally, specifically for separate groups of assets by TURMOB							
4. Financial statements should be available to the general public rather than just to shareholders and managers.							
5. Accounting profession should be self-regulated							
6. Market values are generally less relevant than historic costs							
7. Financial statements of all companies should have standardised							

formats.								
8. Only a minimum amount of detailed data should be included in financial statements.								
9. Professional accountants are the best judges of how to measure A firm's financial position and performance.								
10. Market values should be generally used instead of historic costs								
11. Accounting policies once chosen should not be changed								
12. Information about management and owners should not be included in financial statements								
13. Professional accountants are the best judges of what to disclose in financial statements								
14. In times of rising prices LIFO instead of FIFO should be used in calculations as estimates								
15. The level of detailed standardisation in financial statements should be increased								
16. Management forecasts should be included in financial statements								
17. Professional accountants should maintain high standards of ethical conduct.								

1: Strongly agree, 7: Strongly not agree

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**Economic and Environmental Impacts of Corn Stover Removal for  
Biofuel Production: A Farm Level Case Study**

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**Economic and Environmental Impacts of Corn Stover Removal for  
Biofuel Production: A Farm Level Case Study**

**Abstract**

**Keywords:** Bio-energy, Corn Stover Removal, Economics, Environment, Farm Level, Soil Organic Carbon

Corn stover is emerging as one of the major sustainable sources for cellulosic ethanol production in the U.S and promises to reduce our dependence on conventional fuels. Removal of corn stover for biomass production can provide an additional revenue generating source for farmers. However, removing corn stover can result in environmental and agronomic repercussions. A non-linear programming model is used to study the viability of corn stover removal at a sample farm at Swan Lake Research Farm near Morris, MN. Soil Organic Carbon (SOC) is used for the environmental and agronomic impacts. Results suggest that partial stover removal is possible without having adverse environmental and agronomic impacts when using conservation tillage practices.

## **Economic and Environmental Impacts of Corn Stover Removal for Biofuel Production: A Farm Level Case Study**

### **1. INTRODUCTION**

Cellulosic biofuel feedstocks may offer a better alternative for producing ethanol than grains, such as corn. Use of grains for ethanol production has resulted in a perceived threat by the public and agricultural community of potential food shortages; increased food prices; reduced livestock feed supplies, and environmental degradation. Ethanol produced from cellulosic sources has a better output to input ratio than grain ethanol; and could also prove to be more environmentally friendly and cost effective (Solomon et al; 2007).

Corn stover is emerging as one of the major sources for cellulosic ethanol production in the U.S., due to an abundant supply and beneficial lignocellulosic properties (Wilhelm et al. 2004, Aden et al., 2004). Corn residue can provide as much as 1.7 times more carbon, than residue produced by other crops such as barley, oat, sorghum, soybean, sunflower, and wheat (Allmaras et al., 2000). Using corn stover for producing ethanol might help to further reduce our dependence on conventional fuels.

Removal of corn stover for biomass production can provide an additional revenue generating source for farmers, a potentially significant benefit for farmers. On the other hand, harvesting of corn stover poses both agronomic and environmental costs. These costs include; potential crop yield reductions; degradation in soil quality due to changes in soil organic carbon (SOC) levels; and other undesirable changes in soil properties (e.g. water infiltration, temperature, and nutrient balance) (Wilhelm et al., 2004). Wilhelm et al. (1986) have shown that harvesting of crop residues from the soil surface resulted in lower corn yields in Nebraska due to lower soil organic matter content.

Though maintaining crop residue for soil and water conservation is important, there is the possibility of partial stover removal, which may not significantly affect crop yields, and still help prevent soil erosion and maintain/increase soil organic matter (SOM) and soil organic carbon (SOC) levels. Various studies have suggested that removal of crop residue from the field can be balanced against environment impacts (e.g. soil erosion), so that farmers can maintain soil organic matter levels, and preserve soil productivity. Johnson et al. (2006) studied the impact of crop residue removal on SOC levels using a national grain yield database and highlighted the benefits from reduced tillage and increased biomass production for improving SOM and SOC. They suggested more field

trials using estimates of total C production to ascertain the maximum amount of crop residue that can be harvested while maintaining SOC levels in the soil.

Wilhelm et al, (2004) concluded that corn stover can be removed within limits from the field for use in cellulosic ethanol production. They stressed that removal rates will vary from site to site, and felt the need for a decision-tool that could predict optimal removal rates that are both economically and environmentally feasible. Blanco-Canqui et al., (1998) studied the effect of corn stover removal on crop yields and how this altered soil properties. Blanco-Canqui et al. (1998) found an increase in corn stover removal rates can have a positive, negative or neutral effect on corn yield and suggested that impacts are site specific due to climate, soil topography, tillage system being used and agri-ecosystem characteristics. Both Blanco-Canqui et al (1998), and Wilhelm et al (2004), strongly advocate the need for site-specific modeling to predict the maximum amount of biomass that can be removed to ensure maximum farm profits without having adverse environmental impacts.

The purpose of this paper is to develop a farm level model to study the economic and environmental feasibility of harvesting corn stover for ethanol production. The paper focuses on a case study using experimental data from a research farm in Morris, MN. A non-linear programming profit-maximization model was developed in EXCEL to determine optimal tillage practices and corn stover removal rates while giving due consideration to environmental concerns , such as sustaining or improving soil quality and reducing soil erosion. The model looks at various scenarios, especially the prospect of partial stover removal, which could help farmers maintain eligibility for farm conservation programs.

The remainder of the paper is organized as follows. Section two presents the nonlinear farm model while section three presents the data used in model development. Section four presents the model simulation results and section five provides conclusions.

## 2. THE FARM MODEL

Consider a farmer who is a profit maximizer considering harvesting corn stover as a new cellulosic biofuel feedstock enterprise. Assume the farmer grows two cash crops in a two-year rotation and has the choice of different tillage practices. It is assumed that corn and soybean are given equal acreage. If only cash crops are produced, then the farmer's net return from crop production per acre ( $\Pi$ ) will be given by:

$$\Pi = \sum_{i,j} D_{i,j} (Y_{i,j} P_i^c - w_{i,j}^c) \quad (1)$$

where

$D_{i,j}$  = Dummy variable indicating the choice of tillage practice  $j$  for crop  $i$ ;

$Y_{i,j}$  = Yield per acre of crop  $i$  using tillage practice  $j$ ;

$p_i^c$  = Price (\$) per unit for crop  $i$ ;

$w_{i,j}^c$  = variable cost for producing cash crop  $i$  using tillage practice  $j$  (\$/acre);

$i$  = soybean or corn; and

$j$  = no tillage, strip-till, chisel + disk, or moldboard plow

It is assumed that biomass harvesting is done only for the corn stover. Given that corn stover is a byproduct of the cash crop, it is assumed the farmer does not incur any direct production costs for corn stover. The farmer would incur costs associated with harvesting, moving, loading, storage and transporting of corn stover if it is sold as a biofuel feedstock. When corn stover is harvested, then net returns ( $\Pi$ ) for the farmer become the sum of profit from two revenue resources: crop production and the feedstock enterprise. Thus:

$$\Pi_j = \left[ \sum_{i,j} D_{i,j} (Y_{i,j} p_i^c - w_{i,j}^c) \right] + \left[ (p^b b_j R) - (H^b + L^b b_j R + S^b b_j R + T^b b_j R d) \right] \quad (2)$$

where,

$p^b$  = Price (\$) per unit for corn stover;

$b_j$  = Amount (tons/acre) of corn stover produced using tillage  $j$ ;

$R$  = Percent corn stover removed per acre;

$H^b$  = Harvesting costs for corn stover (\$/acre);

$L^b$  = Loading costs of corn stover (\$/ton);

$S^b$  = Storage costs of corn stover (\$/ton);

$T^b$  = Cost of transporting corn stover (\$/ton/mile)

$d$  = Distance to the refinery

Farmers' net returns from biomass operations are dependent on the amount of biomass harvested. One may expect higher profits with higher biomass removal rates. However, various constraints affect the amount of biomass

that can be harvested. These constraints are in addition to the agronomic and environmental effects discussed above. Current harvesting technologies may not allow 100% harvest for many crops. Since biomass removal may result in increased soil erosion, various conservation programs mandate that a minimum amount of biomass be left on the soil surface to be eligible for incentive payments. For example, USDA requires that at least 30% of the soil surface should be covered with residue to be classified under conservation tillage. Thus, the amount of biomass which can be harvested may be limited to meet program eligibility requirements. This can be modeled by incorporating a biomass removal constraint:

$$R \leq \eta_j \quad (3)$$

where  $\eta_j$  is the maximum permissible level of biomass that can be removed for tillage practice  $j$ . This may be further limited by soil organic constraints.

Soil organic carbon (SOC) changes are dependent upon the amount of biomass removed and are estimated using a response function of the form:

$$C_j = \gamma_j + \delta_j R \quad \forall j \quad (4)$$

Where,  $C_j$  is the annual average change in SOC in lbs/acre/year for tillage practice  $j$ .  $\gamma$  and  $\delta$  are the statistical parameters of the response function.

USDA requires that the level of soil organic carbon should be maintained in order to be eligible for certain conservation payments (e.g. the Conservation Security Program) which requires that  $C_j$  be non-negative.

Removing corn stover may result in lower crop yields due to lower soil productivity as previously discussed. These changes are modeled using crop yield response functions of the form:

$$Y_{i,j} = \alpha_{i,j} + \beta_{i,j} R \quad \forall (i, j), \quad (5)$$

Where  $\alpha$  and  $\beta$  are statistical parameters of the response functions and need to be estimated.

The farmer has the option of trying to maintain cash crop yields that may be reduced from biomass removal by adding supplemental nitrogen and other nutrients to the soil. A farmer would apply these nutrients, only if the cost of the nutrients is less than the additional yield gained from doing so. A response function for the addition of supplemental nitrogen to the cash crop in terms of the amount lost with residue removal can be used to estimate and compare whether farmer would gain by adding extra nitrogen to the crop

$$N_j = \phi_j + \sigma_j R \quad \forall j \quad (6)$$

where,  $N_j$  is the cost of supplemental N applied to maintain cash crop yields (\$/lb/acre)

Finally, the biomass removal rates must be non-negative, i.e. :

$$R \geq 0 \quad (7)$$

### 3. DATA

This section provides the details on how the experimental data was collected and simulated to be used in the model. It further provides details on the collecting economic data and preparing crop budgets.

#### 3.1 Experimental/ Simulated Data and Response Function Estimation

Crop yield data (Table 1) was obtained from a tillage management study conducted at the USDA Agricultural Research Service Swan Lake Research Farm near Morris, MN. While the study design will be briefly described here, further details are available in Archer and Reicosky (2009). This 7 year experiment (1997-2003) studied a corn-soybean rotation with eight tillage systems in a randomized complete block design with five replications. The plot size was 9.1 m wide (12 rows, 76 cm row spacing) by 27.4 m long. Tillage treatments included No Till (NT), Moldboard Plow (MP), Chisel Plow (CP), and five strip till alternatives: Fall Residue Management (RM), Fall RM + Strip Till (ST), Spring RM, Spring RM + ST, and Fall RM + Subsoil. All crop and tillage treatments were present each year. Levels of herbicide application, fertilizer/seeding rates were kept the same for all practices following extension recommendations in Minnesota. Planting and harvest dates for all practices were also kept the same. Out of the eight tillage practices, this study focused on NT, MP, CP and Fall RM + ST to compare two conventional and two conservation tillage systems.

Simulation modeling was conducted using Erosion Productivity Impact Calculator (EPIC) version 0509 (Williams et al., 2006) with the i\_EPIC interface (Gassman et al., 2003). Soil input data were from the SSURGO database (Soil Survey Staff, 2010), and daily weather data were from the University of Minnesota West Central Research and Outreach Center in Morris, MN. Simulation was conducted for a period of 20 years using daily weather data for 1984-2003. Simulation was conducted for a Barnes loam soil, which is a common soil type in western Minnesota as well as eastern North Dakota and northeastern South Dakota and the above mentioned tillage systems study was also predominantly conducted on this soil type. Model parameters were calibrated so that



simulated 1997-2003 average corn and soybean yields matched average observed yields within a range of  $\pm 5\%$  for each of the tillage treatments in the field study.

Modeled management practices were based on the management practices used in four of the tillage system treatments from the field study: moldboard plow (MP), chisel plow (CP), fall residue manager + strip tillage (ST), and no-till (NT). Corn stover harvest treatments were simulated for 10% increments ranging from 0-90% of the above ground biomass. Two nitrogen fertilizer application scenarios were included 1) nitrogen fertilizer rates were determined using the auto-fertilization option in EPIC applying N to meet crop needs, and 2) nitrogen fertilizer rates were held constant at 202 lb N per acre, the average auto-fertilizer determined rate for the CP 0% removal treatment. Simulated yields were then calibrated using actual yields for a more accurate representation of field conditions. The SOC, yield and N response functions were then estimated as a function of the biomass removal rate using regression analysis in EXCEL.

### 3.2 Economic Data

Crop budgets in were tabulated for all 4 tillage practices following Lazarus and Selley (2007) and Archer and Reicosky (2009) (table 2). Machinery costs were based upon Lazarus and Selley (2007) and costs for seeds, fertilizer and herbicides were the actual field costs. All costs are reported in 2008 prices. Annual prices for corn and soybean were five year averages (2003-2007) of the Minnesota price for each crop (USDA, NASS) and were \$2.63bu/acre and \$7.03bu/acre respectively.

### 3.3. Corn Stover Production Costs

Costs for corn stover removal include harvesting (shredding, raking, baling, wrapping, moving), loading, storage and transportation. These costs were based upon Petrolia (2006) and are shown in table 3. Farmers may need to apply additional N, P and K to compensate for the nutrients lost due to corn stover removal, as well. Although the carbon (C) lost due to biomass removal cannot be replenished, the costs for carbon replenishment was included in the model as an opportunity cost for reduced benefits due to carbon loss. Since, carbon prices vary widely amongst different sources, the base carbon price was assumed to be \$0.01/lb. We later used a range of prices (\$0.005 to \$1 per pound) in the final simulations to reflect different pricing scenarios. Prices for nitrogen (0.49\$/lb), phosphorus (0.58\$/lb) and potassium (0.23\$/lb) were also based on five year (2003-2007) average USA prices (USDA, NASS). Additional quantities of supplemental N required to maintain yields was estimated by EPIC and applications for P and K were based upon nutrient removal rates reported by Hoskinson et al. (2007).

## 4. MODEL SIMULATIONS AND RESULTS

### 4.1 Base scenario

A non-linear programming profit-maximization model as described in the model section was developed for the base scenario in EXCEL 2007. For the base scenario, it was assumed that the farmer would be responsible for the harvesting, loading and transport costs. The farmer would not be responsible for the storage costs as he would transport the biomass as soon as it was harvested. The distance to the refinery was assumed to be 50 miles. Since farmers using no-till and strip-till should maintain at least 30% ground cover to maintain eligibility for conservation payments, maximum permissible limits for biomass removal was calculated as 80.65% and 76.45% for no-till and strip till practices respectively (National Agronomy Manual, 2002). For the conventional tillage practices 100% removal was allowed, although the current harvesting techniques don't allow for total removal. It's assumed that the technology would be in place by the time commercial production of cellulosic ethanol commences. Other assumptions for the base scenario include a biomass selling price of \$50/ton.

The base model compared all four tillage practices both with the constant and variable nitrogen scenarios. The results of the base scenario (Table 4) show the farmer would maximize profit by adopting no-till and removing 80.65% of the available corn stover. Since the cost of applying additional nitrogen to maintain yields is more than the financial gain in yields, the farmer would be better off by not applying supplemental N to his crop. That is, the yield loss and subsequent revenue loss from biomass removal is less than the cost of the supplemental N. Table 4 shows that the farmer would earn a profit of \$168.86/acre using constant nitrogen and would make only \$159.77/acre if he adds supplemental nitrogen. The base model results also show the farmer can remove a maximum of 22% of biomass while using a moldboard plow and 80% when using a chisel plow, without having a negative change in SOC. Although no-till and strip-till practices allow the farmer to remove all available biomass without having a negative change in SOC, the model restricts both to 80.65% and 76.45%, respectively, so as to maintain a 30% ground cover in order to meet conservation tillage guidelines (CTIC, 2002). At the base scenario prices, the farmer would make an profit of \$168.86/acre out of which \$23.01 would come from the biomass operations for the optimal practice.

Thus the model shows a possibility of partial stover removal to generate additional revenues for the farmers without affecting the crop yields or soil productivity significantly. Furthermore, it shows the possibility of partial stover removal while also maintaining the eligibility for the farm payments by leaving at 30% ground cover.

## 4.2 Additional Economic Simulations

Simulations were then developed to study the impact of changes in biomass prices, distance to the refinery, and changes in carbon prices on farm profit. For each simulation five scenarios were examined: 1) Farmer is responsible for harvesting, loading, transport and storage costs (HLTS). 2) Farmer is responsible for harvesting, loading and transport costs (HLT). No storage costs are incurred as farmer would transport the biomass as soon as it is harvested. 3) Farmer is responsible for harvesting and loading (HL), and the refinery would be responsible for transport of biomass. 4) Farmer is only responsible for harvesting (H), the refinery would load and transport it. 5) Farmer is not responsible for any production costs (none). The refinery would harvest, load and transport the biomass. These cases represent potential contracting situations which may arise between farmers and bio-refineries for corn stover production (Epplin et al., 2008; Rajagopal et al., 2007).

### 4.2.1 *Change in Biomass Prices*

The results for this scenario are shown in figure 1. Simulation results show that the farmers would breakeven at \$5.1/ton if the refinery agrees to harvest, load and transport at their expense. In case the farmer has to incur these costs and also stores the biomass on his farm till the refinery requires it, the breakeven cost would increase to \$43.2. The farmer would choose the variable nitrogen scenario if he chooses not to remove the biomass and would choose constant nitrogen scenario if he chooses to remove biomass. The maximum profits which can be achieved with no biomass removal are \$146.15. With no-till, a 80.65 % corn stover removal rate, and no additional N application, farm profit per acre would range between \$221.54 and \$272.18 depending upon costs of operations incurred by the farmer.

### 4.2.2 *Change in Distance to Refinery*

The results for this scenario are as shown in figure 2. Distance to the refinery was varied between 10 and 200 miles for two of the scenarios: HLTS and HLT. Results show that farm profit would be maximized at \$164.15 and \$173.87 per acre for each scenario respectively when the refinery is at a distance of 10 miles. The farmer would stop harvesting biomass if the refinery is more than 150 miles and 85 miles for the HLTS and HLT scenarios, respectively.

### 4.2.3 *Change in Carbon Prices*

Although replenishing lost carbon in soil is not possible currently due to technological limitations, the model incorporates the cost of carbon as an opportunity cost of reduced soil benefits from corn stover harvest. The

impact of increased carbon costs, which are more relevant with current agricultural policy are examined. Carbon prices were varied between \$0.01/lb to \$0.20/lb Results show that farm profits would vary between \$155 and \$205.65 per acre for the five scenarios (figure 3). The switchover price at which farmer would not harvest biomass for above five scenarios would be \$0.08, \$0.14, \$0.24, \$0.26 and \$0.42 respectively.

## **5. CONCLUSIONS**

Corn stover removal for ethanol production may prove to be a profitable enterprise for farmers. A sustainable supply may be maintained even after giving due consideration to environmental concerns. Model results support the use of conservation tillage practices, which result in improvements in SOC. Partial stover removal with the adoption of conservation tillage practices could help farmer gain additional revenue while maintaining his eligibility for conservation payments. Extensions of this model would provide an effective policy making implication for conservation payment programs. While current simulations show how much profit the farmer would make by staying under current policy limits, one can change these to more stringent limits to enhance SOC levels. The loss in revenue from the current levels would reflect the required conservation payment to reward a farmer to augment their soil productivity. More research is needed to develop a theoretical model which would address issues on how to develop farm payment programs and also for the prediction of sustainable supply of biofuel feedstocks.

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Table 1: Average Crop Yields at Swan Lake Research Farm near Morris, MN. (1997-2003)

<b>Tillage Practices</b>	<b>Soybean</b>	
	<b>Yield (Bu/acres)</b>	<b>Corn Yield (Bu/acres)</b>
Moldboard Plow	45.90	158.79
Fall residue mgmt and strip till	43.96	161.63
Chisel Plow	45.37	159.72
No-Till	44.09	157.27

*Source: (Archer and Reicosky, 2009)*

Table 2: Cash Crop Budgets for Corn and Soybean, 2008 (\$/acre)

<b>Tillage System</b>	<b>No-till</b>	<b>Moldboard Plow</b>	<b>Chisel Plow</b>	<b>Fall RM + Strip Till</b>
<b>Corn Production Costs:</b>				
Labor	6.89	11.34	9.77	8.67
Repairs	7.54	11.58	9.18	8.73
Diesel Fuel	6.51	13.62	10.39	10.29
Seed, Fertilizer, Herbicide	112.46	112.46	112.46	112.46
Interest	5.03	5.84	5.43	5.37
Depreciation	19.83	32.10	27.47	28.41
Drying Fuel	40.90	39.12	36.21	39.10
<b>Total Operating Costs</b>	199.17	226.06	210.91	213.05
Overhead	14.73	24.98	21.04	21.28
<b>Total Cost</b>	213.90	251.05	231.94	234.33
<b>Soybean Production Costs:</b>				
Labor	6.32	12.04	10.46	8.10
Repairs	6.46	11.35	9.12	7.65
Fuel	5.76	13.89	11.23	9.52
Seed, Fertilizer, Herbicide	70.82	70.82	70.82	70.82
Interest	2.11	3.12	2.72	2.45
Depreciation	16.01	30.53	26.78	24.54
Drying Fuel	1.11	0.66	0.67	0.69
<b>Total Operating costs</b>	108.59	142.40	131.81	123.77
Overhead	12.16	24.54	21.59	18.67
<b>Total Cost</b>	<b>120.75</b>	<b>166.94</b>	<b>153.40</b>	<b>142.44</b>

Source: (Archer and Reicosky, 2009)



Table 3: Biomass costs for Corn Stover Removal

<b>Operation</b>	<b>COST</b>		
Shredding <sup>1</sup>	10.63	\$/acre	
Raking <sup>2</sup>	6.8	\$/acre	
Baling	12.67	\$/acre	
Wrapping	4.6	\$/ton	
Moving	4.57	\$/ton	
Loading	3.1	\$/ton	
Storage	7.31	\$/ton	
Transportation	0.303	\$/ton/mile	w/in 25 miles of plant
	0.198	\$/ton/mile	26-100 miles from plant
	0.16	\$/ton/mile	>100 miles from plant

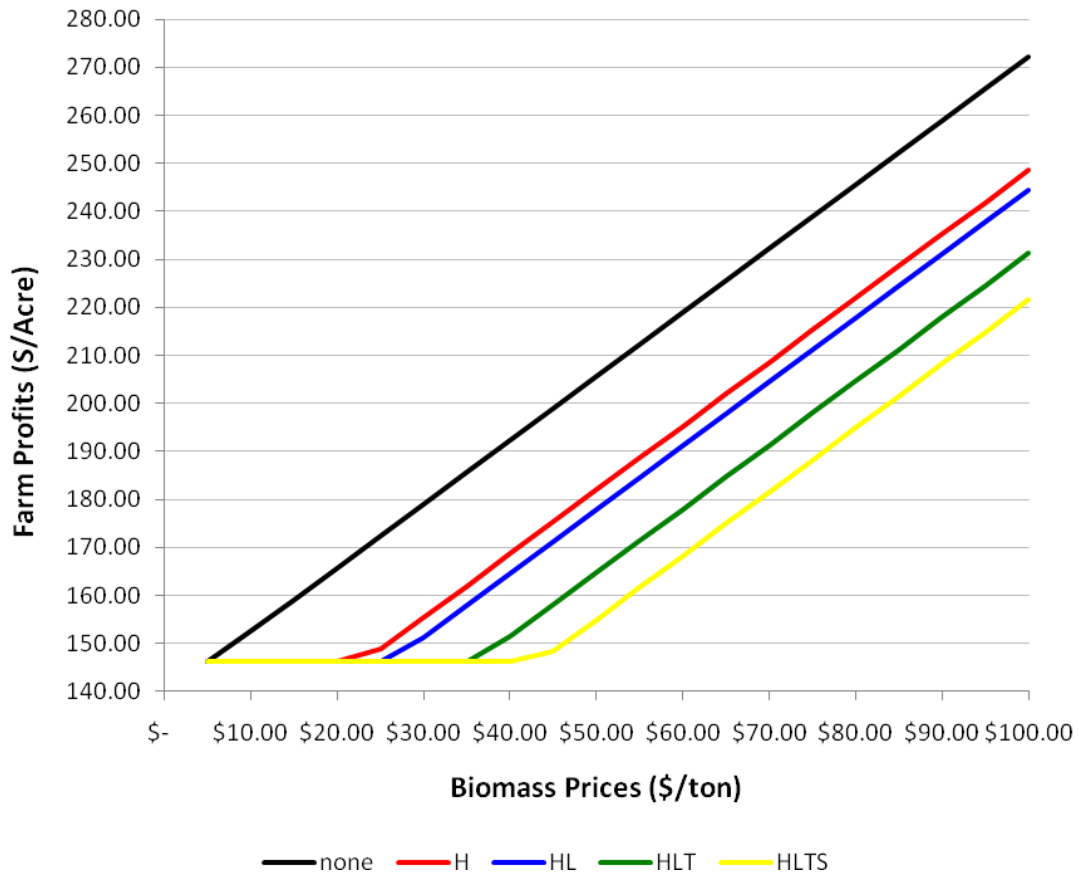
*Source: (Petrolia, 2006)*

<sup>1</sup> Assumed this was done in CT regardless of whether biomass harvested. For ST it is assumed this would only be used if raking (>30% harvest)

<sup>2</sup> Assumed this would only be used for >30% harvest, otherwise could just bale the windrow.

**Table 4: Comparison Farm Profits under Different Tillage Practices**

<b>Tillage System</b>	<b>MP</b>	<b>ST</b>	<b>CP</b>	<b>NT</b>	<b>MP</b>	<b>ST</b>	<b>CP</b>	<b>NT</b>
	-----Supplemental Nitrogen -----				-----Constant Nitrogen -----			
% BM Removed	0.22	0.76	0.80	0.81	0.21	0.76	0.80	0.81
SOC	0.00	121.62	0.00	84.03	0.00	123.38	0.00	83.32
Corn Profit	35.04	46.59	44.57	52.24	33.91	45.98	43.98	50.47
Soybean Profit	77.83	84.32	82.99	95.37	77.83	84.32	82.98	95.37
BM Profit	1.23	12.00	16.44	12.16	3.77	22.08	27.43	23.01
<b>Total Profit</b>	<b>114.10</b>	<b>142.91</b>	<b>144.00</b>	<b>159.77</b>	<b>115.51</b>	<b>152.39</b>	<b>154.40</b>	<b>168.86</b>



**Figure 1: Change in Farm Profits with change in Biomass Prices**

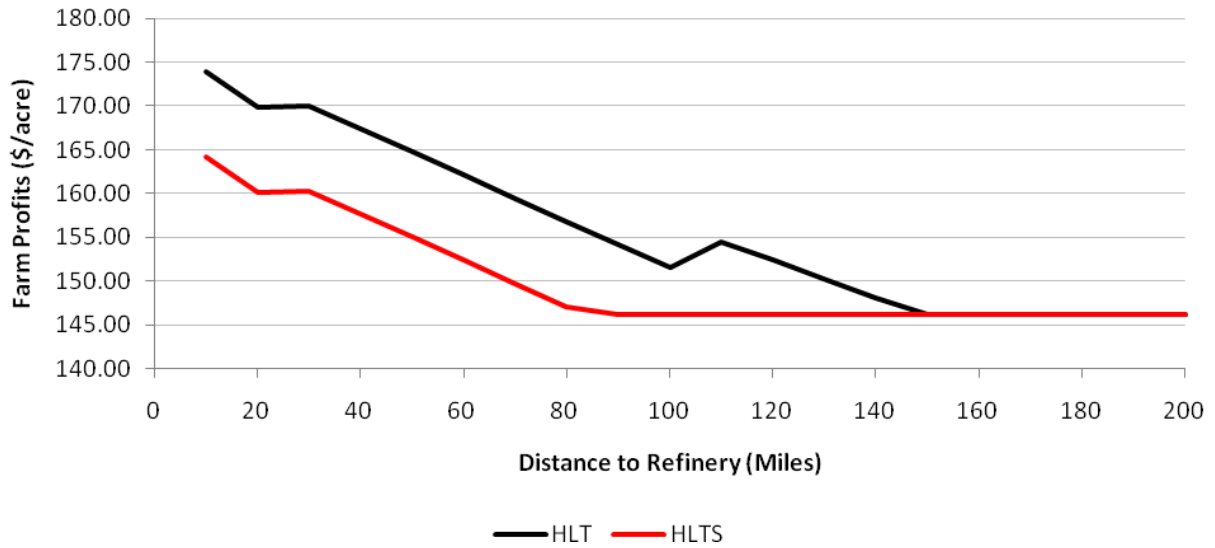
*None: Farmer is not responsible for harvesting, loading, transport and storage costs*

*H: Farmer is responsible only for the harvesting costs*

*HL: Farmer is responsible for harvesting and loading costs*

*HLT: Farmer is responsible for harvesting, loading and transport costs*

*HLTS: Farmer is responsible for harvesting, loading, transport and storage costs*



**Figure 2: Change in farm profits with change in distance to refinery**

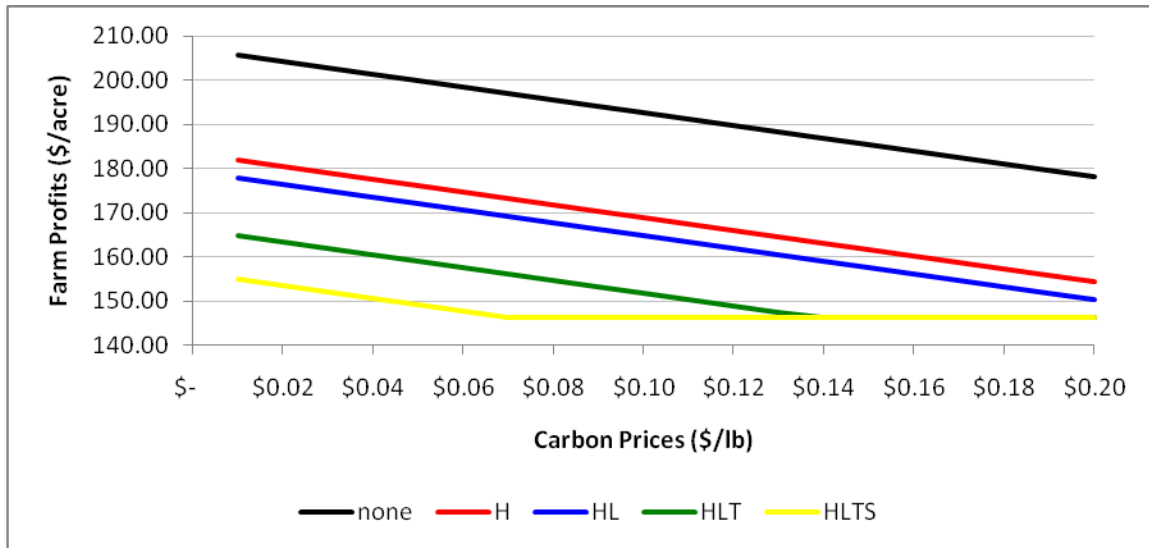
*None: Farmer is not responsible for harvesting, loading, transport and storage costs*

*H: Farmer is responsible only for the harvesting costs*

*HL: Farmer is responsible for harvesting and loading costs*

*HLT: Farmer is responsible for harvesting, loading and transport costs*

*HLTS: Farmer is responsible for harvesting, loading, transport and storage costs*



**Figure 3: Change in Farm Profits with change in carbon prices**

*None: Farmer is not responsible for harvesting, loading, transport and storage costs*

*H: Farmer is responsible only for the harvesting costs*

*HL: Farmer is responsible for harvesting and loading costs*

*HLT: Farmer is responsible for harvesting, loading and transport costs*

*HLTS: Farmer is responsible for harvesting, loading, transport and storage costs*

## Marketing, Economic, Financial, and Environmental Opportunities for Anaerobic Digesters and Manure Management

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**Abstract:** Livestock producers operating large-scale confinement operations, such as dairies, are looking for ways to handle and dispose of manure that are cost effective and efficiently meet odor and pollution policies. Farm level production of biogas using anaerobic digesters is one solution that helps control methane emissions. Methane is an odorless gas that can be used to generate electricity, develop fiber products (such as fiber boards, decking, cow pots and building materials) and potting medium as a soil or peat replacement and livestock bedding, establish carbon credits, or provide other value-added products like fertilizer and raw gas or transport fuel, thereby having marketability and economic value. Substantial environmental benefits of odor control, water quality protection, and greenhouse gas reductions also exist. Because of the tangible and intangible benefits possible from reducing methane emissions via anaerobic digesters, biogas recovery systems are prudent financially, with single-digit payback periods, double-digit simple rates of return, approximately \$1 million (USD) in net present value, double-digit internal rates of return, and relatively large benefit-cost ratios associated with the savings over time.

### Biogas Recovery Systems

There are four (4) components to a biogas recovery system: a manure collection system, an anaerobic digester, a biogas collection system, and a gas use device (Figure 1).

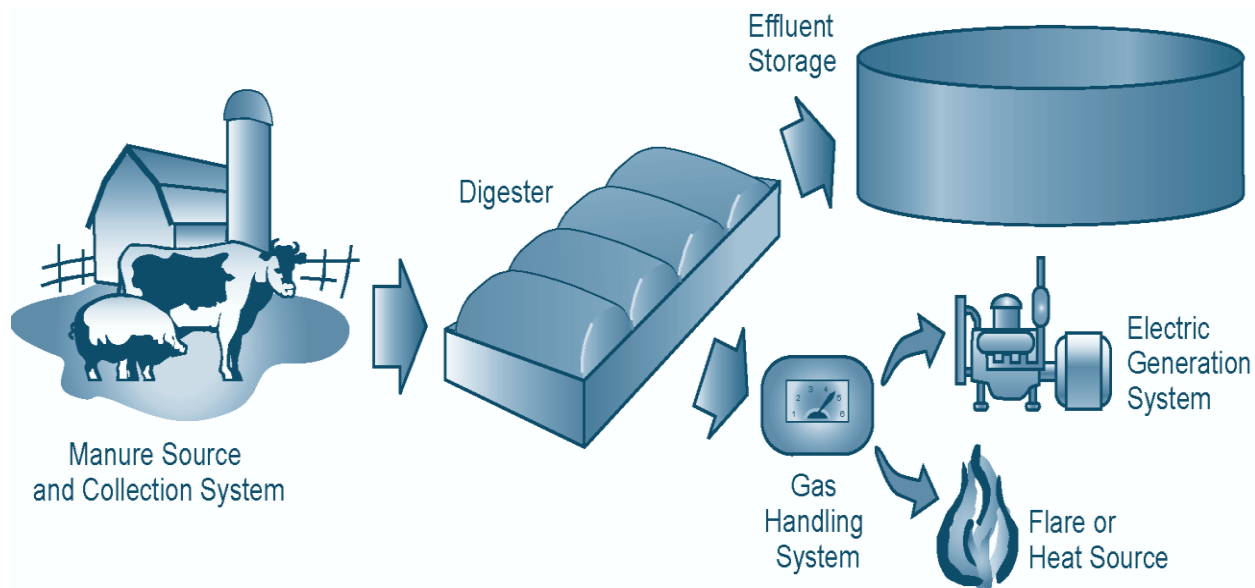


Figure 1. Schematic showing the components and products of a biogas recovery system.

The three (3) most prominent biogas recovery system designs used at United States farms are the (Figure 2):

- Covered anaerobic lagoon – the least costly, simplest and most commonly used; uses a flexible cover over a liquid manure (0.5% - 3.0% total solids); needs high average ambient temperatures (located between 40 degrees north and south latitudes) to produce more methane;
- Plug flow digester – a long, narrow heated tank with either a rigid or flexible cover; limited to dairy manure collected by scraping (a semi-solid manure of 11% - 13% total solids); and
- Complete mix digester – an enclosed, heated tank with either a mechanical, hydraulic, or gas mixing system; works best when there is some dilution of excreted manure (a slurry of 3% - 11% total solids) with process water, such as milking center wastewater.

Anaerobic digesters could include other organic waste feed stocks, other than manure. These feed stocks could include, as examples, cheese whey, ice cream, brewery waste, winery waste, and greases and oils (US/EPA).

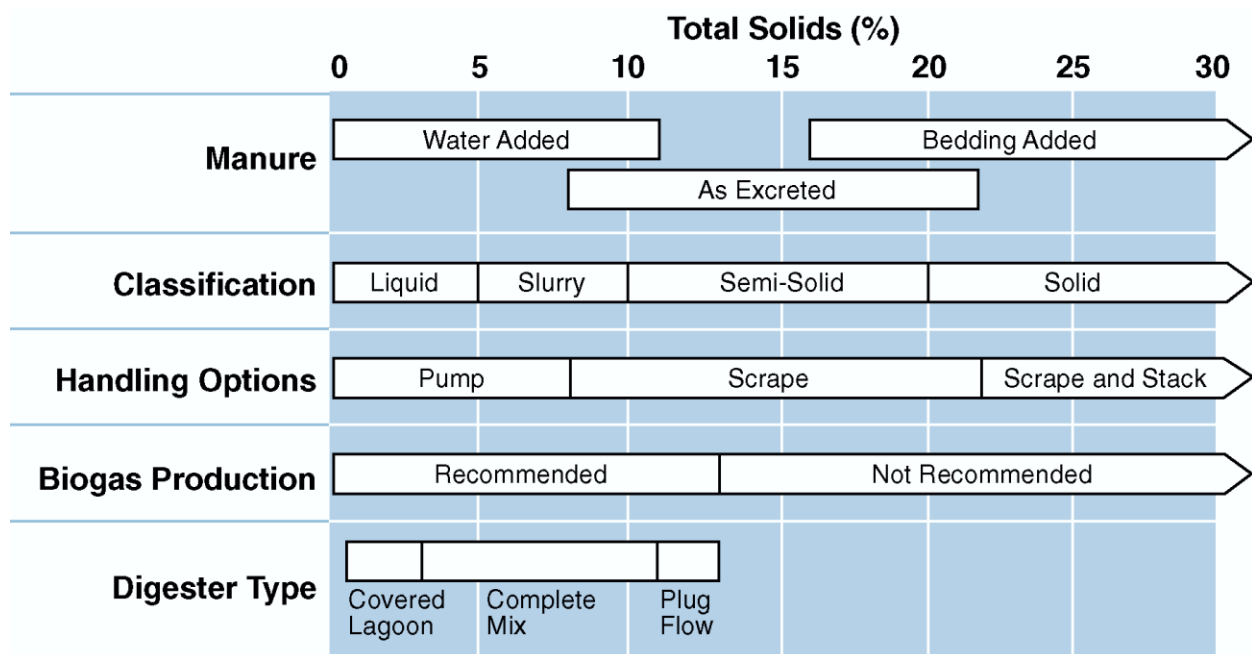


Figure 2. Appropriate manure characteristics and handling systems for specific types of biogas digester systems.

An overview of the complexity and costliness of each of these three digester processes follows:

Digester	Process	Operational	Capital	Operating
Process	Complexity	Complexity	Costs	Costs
Covered lagoon	low	low	low	low
Plug flow	low	low	low	low
Complete mix	medium	medium	medium	medium

There are four (4) potential advantages to installing and utilizing a biogas recovery system (US/EPA):

- Economy of scale – significant economic benefits occur as the biogas production capacity increases;
- Marketing leverage – marketing of energy/fuels and electricity, by-products, and co-products enhances total revenue and improves cash flow;
- Financing – increased availability and sources of venture capital, as well as grants, tax credits, and renewable energy programs for financial assistance exist, and acceptable financial management values for payback period, simple rate of return, net present value, benefit-cost ratio, and internal rate of return result; and
- Environmental benefits – odor control, water quality protection, and greenhouse gas reductions are the three substantial environmental benefits.

### Marketing Opportunities

Co-product markets are essential for the economic viability of anaerobic digesters and establishing value for the reduced methane emissions processes. An Environmental Protection Agency (EPA) sponsored partnership of building public and private sector alliances to advance the recovery and use of methane at livestock manure management operations is entitled “Methane to Markets,” which suggests that there is market value in the by- and co-products of manure management. Reducing methane emissions (methane is a potent greenhouse gas when released to the atmosphere) can yield substantial economic, environmental, financial, and marketing benefits.

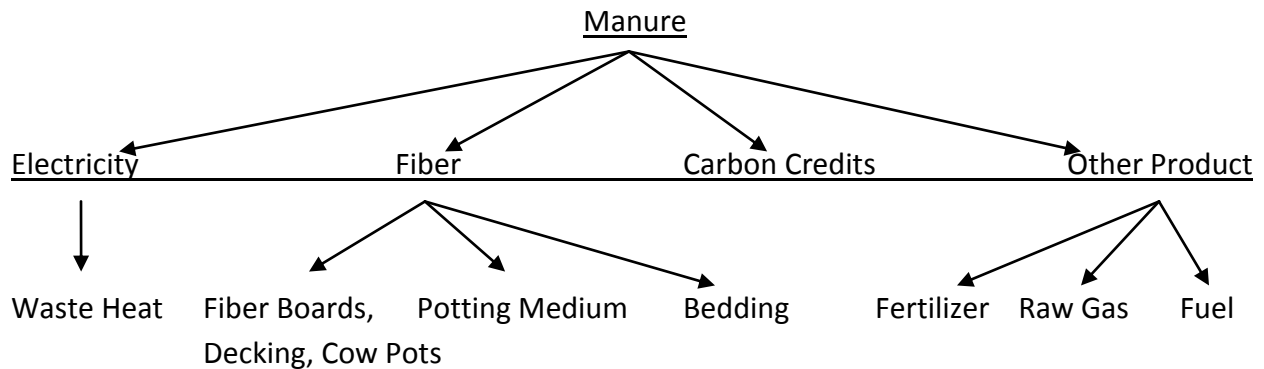
Biogas is 60% - 65% methane, with carbon dioxide, hydrogen sulfide and trace amounts of water accounting for the remaining 35% - 40%. It is a medium-Btu fuel that can be used to generate electricity (hence, electricity becomes an avoided cost) for potential selling to others or the utility company, or biogas can be burned in natural-gas or propane boilers and space heaters as a waste heat source, while having market value.



Carbon credits also have market value. In the US, the Chicago Carbon Market is the principal agricultural carbon credit market that establishes value for the reduced methane emissions from manure using an anaerobic digester.

Various fiber products can also be marketed from the manure. Fiber boards and decking planks are examples of fiber products that use 50% dried manure and 50% recycled corrugated products. An extension of the fiber boards and decking is the manufacture of building materials from recycled products. Cow pots formed from manure and recycled products are marketed for use as biodegradable flower pots and containers for the landscape and environmental horticulture industry. A potting medium as a soil/peat replacement can also be developed as a fiber product for the horticultural industry. Bedding for the livestock industry is yet another fiber-based product provided from dried manure.

Other value-added co-products include fertilizer (repeated sampling and testing must occur to ensure consistency of product) and raw gas for flaring as well as transport fuel. All of the aforementioned products generate marketing leverage.



**Economic Opportunities**

In identifying profitable biogas recovery systems for dairy operations, the common characteristics are dairies with milking herds of more than 500 head located in flushed free-stall barns – this is where the economies of scale exist. Profitability depends on the ability of the entrepreneur to recover the capital and operating costs at a reasonable rate of return, and to generate a long term income stream. Specifically, three economic aspects influence the overall profitability of the operation: the size of the operation plus local factors (construction costs; energy prices; farm management practices), the manure management system utilized (manure handled in a liquid, slurry or semi-solid state; collection frequency), and the current/forecast energy prices (avoided cost of electricity; possible sale of excess electricity; waste heat recovery; sale of carbon credits through brokerage houses to global greenhouse gas markets).

Experience demonstrates, however, significant economic benefits as biogas production capacity increases, although the cost of anaerobic digestion of dairy cattle manure for biogas production and utilization will vary with the system type and size, type of livestock operation, and site specific conditions. Using vendor quotes to provide preliminary guidance for estimating capital costs, the data represents the cost of the digester, the engine-generator set,

engineering design, and installation (excluding utility line upgrades and interconnection equipment costs and fees. The total capital cost of the three anaerobic digestion systems – the complete mix, the plug flow, and the covered lagoon – is shown in Figure 3, whereas the capital cost per dairy cow for the three systems is shown in Figure 4; both figures are shown with respect to the number of dairy cows for the specific design ([www.epa.gov/agstar](http://www.epa.gov/agstar)).

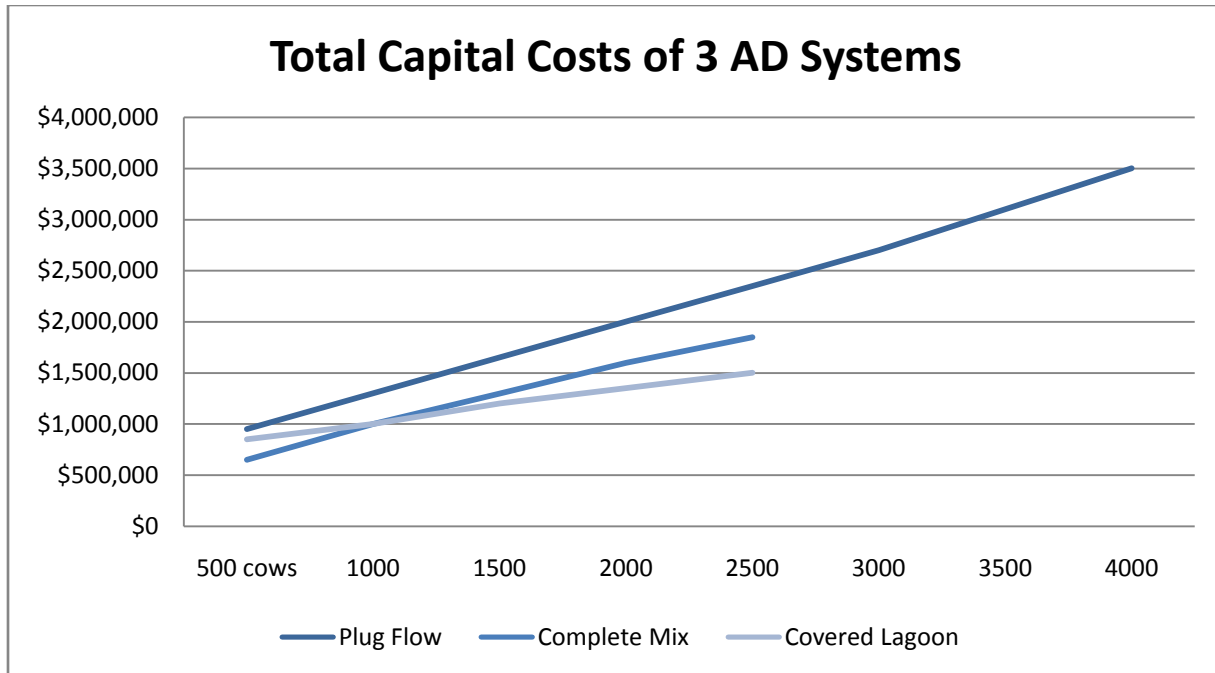


Figure 3. Total Capital Cost of Complete Mix, Plug Flow, and Covered Lagoon AD Systems.

### Financing Opportunities

Due to the scale of the project, additional sources of venture capital may be available as well as assistance from grants, tax credits, or renewable energy programs as noted in the 2008 Farm Bill. In reviewing the protocol for quantifying and reporting the performance of anaerobic digestion systems for livestock manures, an approach for evaluating the economic and financial viability is established. Sections of the financial analysis to be included are a write-up of the general approach; the boundary conditions; the annual capital cost (which embodies two assumptions: recovery of the capital invested and the retirement of debt financing will occur at the same interest rate and as an annuity over the useful life of the system, and an estimate of the useful life of the system must be made, typically 20 years); annual operation, maintenance, and other costs; annual revenue; and net income.

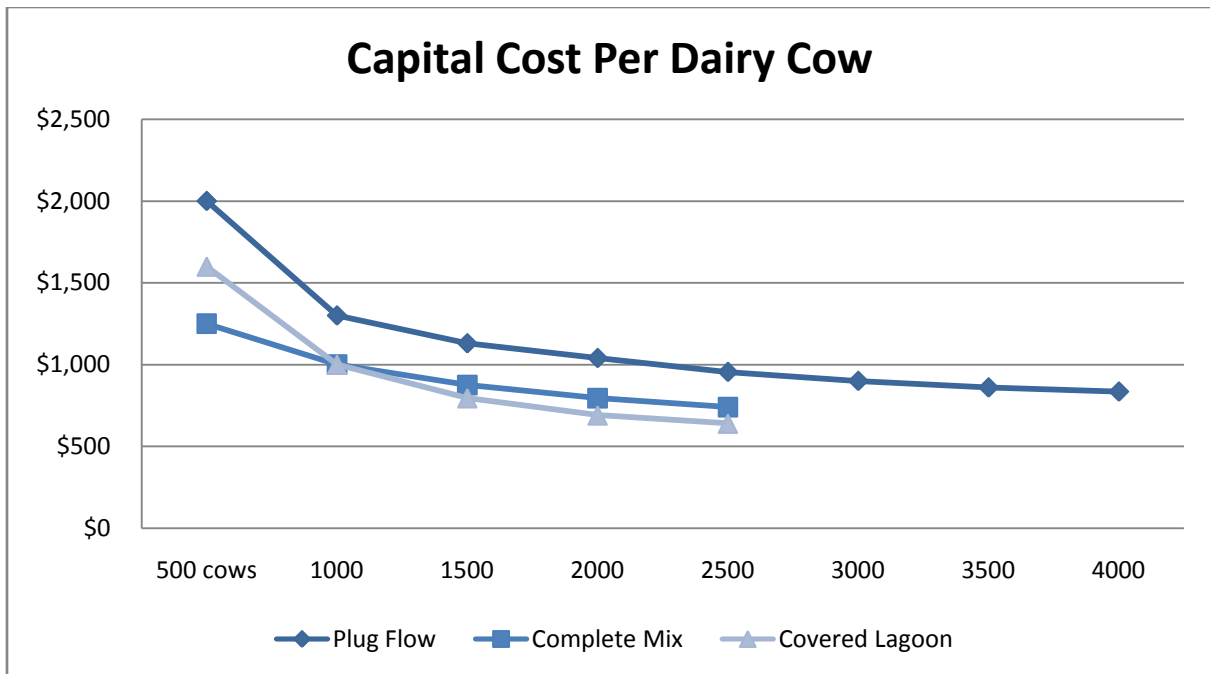


Figure 4. Capital Cost Per Dairy Cow for Complete Mix, Plug Flow and Covered Lagoon Systems.

With the covered lagoon total capital costs and capital cost per cow both being graphically portrayed as being low relative to the plug flow and complete mix anaerobic digester systems, as well as the covered lagoon system being the most commonly employed of the three systems, the financial analysis data is being shown for the covered lagoon system only. Rather than calculating the information suggested as protocol, financial data representing the five financial evaluation tools of the payback period, the simple or accounting rate of return, the net present value, the benefit – cost ratio, and the internal rate of return were calculated for each of five dairy operations with approximately 2,000 head of dairy cows and then the averages determined where applicable. The monetary savings in the calculations are from avoidable costs (electricity purchased and transportation off-site of manure, primarily), and do not include revenue generated from the marketing of any of the products mentioned in the discussion of “marketing opportunities.”

Payback Period	12.5 years
Simple or Accounting Rate of Return	8.0%
Net Present Value (10%, 20 years)	approximately \$600,000
Benefit – Cost Ratio	4.075
Internal Rate of Return	approximately 25%

## Environmental Opportunities

One of the biggest challenges facing dairy operators is managing manure and process water in a way that reduces odor and protects environmental quality at a reasonable cost. Biogas recovery systems will reduce odors, protect water quality, and reduce greenhouse gas emissions, as shown in the following table (US/EPA):

Option	Odor Control	Greenhouse Gas Reduction	Water Quality Protection
Covered Lagoon	Excellent	High	Good
Heated Digesters	Excellent	High	Good

(complete mix and plug flow both rely on external heating)

In order to capture these environmental opportunities, one approach is the AgSTAR program, a voluntary outreach effort jointly sponsored by EPA, USDA, and US Department of Energy that encourages the use of methane recovery (biogas) technologies at confined animal feeding operations that manage manure as liquids or slurries. These technologies reduce methane emissions while achieving other environmental benefits. The AgSTAR program provides technical support to livestock waste management that integrates policy development and implementation, technological solutions, capacity building, and regional connections.

The Methane to Markets (M2M) program also explains how the values associated with the co-products of biogas capture and methane reduction enhance the economic feasibility of any manure management system. The M2M program is a multi-national collaborative effort in over 60 countries that focuses on reducing greenhouse gas emissions through appropriate manure management strategies.

Society must also recognize the importance of reducing methane emissions, controlling odor, improving water quality, and generating rural or community economic activity, and that the positive value of these intangibles improves the quality of life of the citizenry. Participation in the Methane to Markets and the AgSTAR programs help mitigate greenhouse gas emissions and climate change. The recovery and use of methane is recognized as a valuable source of clean energy, a means to advance energy security, a way to improve environmental quality, and a process that reduces greenhouse gas emissions.

## Identified Barriers (or Opportunities?) to Biogas Recovery System Implementation

To summarize the marketing, economic, financial, and environmental opportunities, there are several identified barriers to successful utilization of biogas recovery systems for implementing methane capture and utilization projects. These barriers, summarized below, are really masked or hidden opportunities for future collaboration and investigation, rather than negative consequences.

### Institutional Barriers:

- ✓ Not enough current or contemporary research that either models or evaluates the realities of current technologies.
- ✓ Environmental laws not adequately enforced, so free-rider encouragement and no incentive to participate.
- ✓ Lack of information on the economic performance of the livestock sector and manure management scenarios, on the market value of by-products and co-products from livestock manure, and on the social valuation of environmental output or products.
- ✓ Power generation with biogas may not be an appealing choice due to regulations and costs of installation, operation and transmission of the energy components.

### Technological Barriers:

- ✓ Too much heterogeneity with respect to size and use of the biogas recovery technology.
- ✓ Few developers of anaerobic digestion technologies, especially for the smaller livestock operations (animal units).
- ✓ Lack of guidelines for development, construction, installation, and performance evaluation of anaerobic digestion systems.
- ✓ Relatively high operational and maintenance costs.
- ✓ Lack of comprehensive waste management and wastewater management plans for livestock manure.

### Economic Barriers:

- ✓ Uncertainty with regards to profitability levels for livestock producers, especially dairy farms (market values of fixed assets, prices for inputs and fluid raw milk, costs of doing business).
- ✓ Livestock producers unaware of emission markets (carbon credits) or by-products and by- or co-product markets, as incentives to participate.
- ✓ Difficulty in valuing positive externalities (water and air quality) of operations, especially those in densely populated areas (centralized markets).
- ✓ Uncertainty as to how to capture environmental value-added by public and private stakeholders – should there be an environmental subsidy to the private operator?
- ✓ Need for a common protocol for quantifying and reporting total economic performance of anaerobic digestion systems – a protocol that recognizes the informational needs of any funding or management agency/business/organization.

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## **EXPLAINING FRESHMAN RETENTION RATES BETWEEN COLLEGES: APPLICATIONS TO SEDIS SCHOOLS**

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### **ABSTRACT**

Regression results for a sample of 367 colleges and universities identify important determinants of differing rates of freshman-to-sophomore retention. Factors representing the quality of the institution (percentage of faculty holding PhDs, SAT scores, and admissions acceptance rates) help to explain retention rate variations between these schools. Other factors related to retention rates include the following: whether the institution is private or public, tuition levels, the percentage of freshmen housed on campus, and grades, proxied by the percentage of the freshman class in good academic standing at the end of the freshman year.

### **INTRODUCTION**

Freshman retention rates vary widely among colleges and universities. The most recent College Board Data Set cites freshmen retention rates for colleges and universities ranging from 99% to 40%. What are the determinants of these wide variations in freshman retention rates? It is clear from casual observation and previous research [3] that “better” schools—ones with higher SATs, lower acceptance rates, and more faculty with PhDs—have higher retention rates. It is, however, also clear that important variations in retention rates are present for schools which would be considered very similar based on the above criteria. What, then, determines those variations in retention rates?

Using two- and three-stage least squares regression techniques, Marcus [3] finds relatively few variables as statistically significant determinants of freshman retention. Those determinants include SATs, the acceptance rate, and whether the school required an interview prior to acceptance. Parallel research [4] suggests that freshman grades and participation in extracurricular activities are also important determinants of individual student retention.

This research estimates the relationship between retention and its determinants for a large sample of U.S. colleges and universities using recently available (2006) data (Marcus’ 1989 paper used 1982 data). We employ ordinary least squares (ols) and two-stage least squares (2sls) estimation methods. The latter technique corrects for possible simultaneity in the regressions. In addition, this paper includes the effects of freshman grades, and a dummy variable representing whether the institution is public or private, and the influence of the proportion of the freshman class housed on campus. This evidence on retention may be useful to colleges and universities in their

efforts to raise rates of freshman persistence. The resulting estimations also allow calculations for individual schools to determine whether their persistence rates are high or low as compared to predicted rates—that is, is the persistence rate for College X higher or lower than the rates that would be predicted for schools with similar characteristics?

## DATA

The data in our study come from the *College Board, Annual Survey of Colleges*. For a detailed analysis of data construction see the College Board Common Data Set web site. This research utilizes the 2005-06 research file. Data from almost 4000 public and private undergraduate institutions were included in this data set. After excluding non four-year institutions and institutions that did not report freshman-to-sophomore retention, the data set contained only 971 observations.

## MODELING CONSIDERATIONS

Several modeling considerations are important in attempting to estimate the effects of various variables on the retention rates across colleges and universities. The choice of explanatory variables, the form of the dependent variable, and the appropriate econometric technique are discussed in this section.

### **Variable Choice and the Effect on Sample Size**

Colleges and universities do not report data on every variable in the College Board Common Data Set. For example, only 1345 of almost 4000 schools report SAT scores, and (as mentioned above) only 971 schools report freshman-to-sophomore retention rates. Therefore, each time variables are added to a regression model, the number of observations (schools) included in the sample decreases. If the schools that remain in the sample differ in terms of retention and important explanatory variables from those schools that are excluded, the results reported here are compromised accordingly. Preliminary analysis (regressions with larger numbers of schools included with fewer explanatory variables) does not suggest that this is a significant problem.

### **Dependent Variable: Definition and Form**

The data for the freshman-to-sophomore retention rate variable are reported as percentages, the vast majority of which are between 60% and 98%. (These retention rates track the entering freshman class as of the “census” date, and compute the percentage of those students who return for the sophomore year.) The dependent variable, then, varies on a relatively short interval. It is, however, roughly continuous on that interval. Fitted (predicted) values of the dependent variable are of interest since they will suggest whether a given college or university retention rate is above or below what would be predicted for a particular set of explanatory variables. If the dependent variable is modeled as a simple percentage, the predicted values from the regression are not restricted to be less than 100%. That is, some schools could have predicted retention rates exceeding 100%. (We actually checked this possibility. For the model with retention rates modeled as a percentage, only M.I.T. had a predicted retention rate exceeding 100%. That predicted rate was 100.9%. All others were less than 100.)



A common remedy for this problem is to transform the retention rate by the “log of the odds”, i.e.,  $\ln(p/(1-p))$ , where  $p$  equals the rate of retention expressed as a proportion and  $\ln$  represents the natural log. This transformation ensures a larger range of variation for the variable and that the predicted values (after taking the antilog and solving for  $p$ ) will lie on the  $[0, 1]$  interval.

Since it seems something of a judgment call as to which form of the dependent variable to choose, we report results with both forms. Most, but not all, results are robust with regard to either form of the dependent variable.

### Econometric Technique

Marcus [3] suggests that several of the structural variables in retention regressions similar to those reported here are simultaneously determined. If true, the ordinary least squares technique results in biased and inconsistent parameter estimates. Marcus argues that at least two of the potential explanatory variables, namely SAT and the acceptance rate are *endogenous*. The argument would be that schools with higher retention rates (perhaps because the school is rated more highly) attract students with higher SATs and such schools also have lower acceptance rates. Relatively simple tests are employed to test for simultaneous equation bias. We report results for both ordinary least squares and two-stage least squares.

### SUMMARY STATISTICS OF THE SAMPLE

Tables I and II contain some characteristics of the sample we use for the regression estimates separated by public (Table I) and private (Table II) schools. (See the next section for detailed definitions.)

**TABLE I: CHARACTERISTICS OF THE SAMPLE OF PUBLIC COLLEGES AND UNIVERSITIES**

Series	Mean	SD	Min	Max
<b>RETENTION RATE</b>	76.86	8.94	52	97
<b>% GOOD STANDING</b>	82.98	9.59	49	100
<b>TUITION</b>	4730.34	2159.38	0	10590
<b>FRESH AID</b>	7561.83	2958.88	0	16068
<b>ENROLLMENT (FRESH)</b>	1990.86	1562.75	175	7076
<b>SAT</b>	1078.76	100.14	865	1340
<b>% FRESH. HOUS</b>	70.29	25.17	7	100
<b>ACCEPT RATE</b>	69.49	17.13	14.05	100
<b>PHD %</b>	80.39	15.71	1.21	100
<b>STUDENT/FAC</b>	3.84	1.35	1.40	11.33

$n = 93$

Several of the means are similar across the public and the private samples. The mean freshman-to-sophomore retention rates are very similar, with private schools averaging one percentage point higher. Acceptance rates and the percentage of full-time faculty holding the PhD degree

are also similar. The percentage of freshmen reported in good standing is somewhat higher for the private colleges and universities as is the percentage of freshman housed on campus. SATs are slightly higher at private schools.

**TABLE II: CHARACTERISTICS OF THE SAMPLE OF PRIVATE COLLEGES AND UNIVERSITIES**

<b>Series</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
<b>RETENTION RATE</b>	77.86	10.76	45	98
<b>% GOOD STANDING</b>	87.14	9.72	36	100
<b>TUITION</b>	23777.58	6398.88	6150	37934
<b>FRESH AID</b>	18060.2	5383.95	2288	31935
<b>ENROLLMENT (FRESH)</b>	529.95	524.33	17	4124
<b>SAT</b>	1108.19	125.29	820	1470
<b>% FRESH. HOUS</b>	84.15	18.32	2	100
<b>ACCEPT RATE</b>	66.62	17.27	9.69	100
<b>PHD %</b>	78.47	16.23	0.95	100
<b>STUDENT/FAC</b>	3.66	1.44	0.84	16.3

n = 274

Of course, private tuition is higher as is reported aid to freshman. Publics average higher total freshman enrollments. Much of this is unsurprising. We also calculated the freshman class size to full-time faculty ratio and found that ratio to be only slightly higher for the public schools in our sample. Of course public schools are more likely to have graduate schools and their faculty may have lower teaching loads. The database did not contain the average size of individual academic classes. In other words we do not know the student/faculty ratio for the classes in which freshmen are enrolled.

### REGRESSION RESULTS

Table III contains the regression results for ordinary least squares (ols) and two-stage least squares (2sls) where the dependent variable is the simple percentage retention rate (percent of bachelor's degree seeking students enrolled for a second year database definitions).

The explanatory variable set in each regression consists of:

SAT = combined verbal and math SAT scores

% in good standing = the percentage of students in good academic standing at the end of the freshman year<sup>1</sup>

public/private = 1 if a public college or university, 0 otherwise

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<sup>1</sup> The College Board leaves the definition of this variable to the individual institutions. For Randolph-Macon College, it is measured as the percentage of freshmen eligible to return for the sophomore year.

tuition = tuition level

% PhD = the percentage of the faculty holding the PhD degree

% campus housing = the percentage of freshmen students residing on campus

**TABLE III: REGRESSION RESULTS FOR RETENTION**

Dependent variable = percentage retention rate

parameter estimate	ols	2sls
intercept	-6.73 (-2.11)	-13.94 (-2.38)
SAT	.0424 (1.63)	.0510 (5.18)
% in good standing	.2706 (7.80)	.2272 (4.93)
private/public	7.72 (5.44)	5.05 (2.17)
tuition	.0003 (4.31)	.0002 (1.33)
% PhD	.0336 (1.64)	.0189 (0.81)
% campus housing	.0508 (3.07)	.0295 (1.32)
$\bar{R}^2$	.716	.702
n observations	367	367

(t-scores in parentheses)

The coefficient estimates in Table III are generally consistent with expectations, with perhaps two exceptions which are discussed later in this paragraph. Higher SAT scores, tuition levels, and PhD percentages all indicate higher quality institutions with typically better student performance and, therefore, greater rates of persistence, as anticipated. Note that the table does

not include the acceptance rate since it was not statistically (or practically) different from zero in either OLS or 2SLS regressions. Holding the effects of the other variables in the regression constant, public colleges and universities average nearly an 8% higher rate of retention. This latter result may be somewhat surprising, given that private colleges in the sample have a slightly higher retention rate than that for public institutions. However, private colleges differ in other respects such as significantly higher SAT scores and higher tuition. The dummy variable indicates that after controlling for those factors, private schools have lower rates of persistence. The persistence rate is also positively influenced by the percentage of freshmen housed on campus.

Since other research [4] suggests that individual retention is influenced by grades, a variable measuring the percentage of freshmen in good standing, available in the College Board Data Set, is employed as a proxy. In every regression, the estimated parameter for that variable is statistically important.

In summary, each explanatory variable coefficient has the anticipated sign and each meets reasonable tests of statistical significance, at least for the OLS estimates. The equation explains over 70% of the variation in the retention rates across a large sample of schools.

Casual examination of the ols and 2sls estimates in Table III suggests little variation in the coefficient estimates between the two techniques. We performed two tests of the hypothesis of simultaneity. The first was a straightforward “Hausman” test, which tests whether the estimates of the “ $\beta$ ” coefficients differ significantly between ols and 2sls techniques. This test, often cited as a test of endogeneity, is better described as a test of whether the endogeneity has a significant effect on the estimates of the  $\beta$  coefficients. This test indicates little effect of the endogeneity on the estimated coefficients. Again, comparison of the coefficient estimates between ols and 2sls confirms the results of this test. Another method of testing endogeneity involves capturing the residuals from first stage regressions, adding the residual series to the main regression and testing under ols that the coefficients on the residual series are zero. Under this test, the null hypothesis of no simultaneity cannot be rejected even at the  $\alpha = .10$  level (see, for example, Woodridge [6], p. 483).

Table IV contains the estimated regressions for the transformed dependent variable. Three aspects of the results deserve emphasis. First, the acceptance rate, which is not statistically significant with percentage retention (untransformed) as the dependent variable as in Table III, is statistically significant for OLS, but not for 2sls with the transformed dependent variable as shown in Table IV. The latter result may suggest that the instruments for the acceptance rate are weak. In fact, the first-stage regressions produced an  $\bar{R}^2 = .17$  and an F-statistic of 16. Some authors suggest that the instrumental variables technique is unreliable if  $F < 10$  (see Stock and Watson [5], p 441). Second, the overall fit of the OLS regression is similar to that of Table III; the 2sls equation is less impressive. Third, again, Hausman tests for the regressions in Table IV do not indicate that possible endogeneity significantly affects the coefficient estimates.

Since the upper bound on predicted persistence rates for the untransformed dependent variable is violated for only one school and since OLS is deemed appropriate by available tests, the analysis in the following section is based on the OLS regressions from Table III.

**TABLE IV: REGRESSION RESULTS FOR TRANSFORMED RETENTION**Dependent variable = transformed retention,  $\ln(p/(1-p))$ 

parameter estimate	ols	2sls
intercept	-3.66 (-13.29)	-8.78 (-0.76)
SAT	.0030 (12.22)	.0065 (1.28)
accept %	-.0054 (-4.28)	.0245 (0.31)
% in good standing	.0151 (6.89)	.0128 (1.71)
private/public	.5033 (5.53)	.3854 (.80)
tuition	.0022*10 <sup>-2</sup> (5.09)	.0017*10 <sup>-2</sup> (2.39)
% PhD	.0010 (0.76)	-.0023 (-0.43)
% campus housing	.0018 (1.76)	-.0067*10 <sup>-2</sup> (-0.03)
$\bar{R}^2$	.762	.362
n observations	367	367

(t-scores in parentheses)

**SOME APPLICATIONS FOR SEDSI SCHOOLS**

In this section the sample of schools is composed of the Colleges and Universities that were represented at the 2009 SEDSI annual meeting. Table V contains retention rates (sorted from highest to lowest) for those SEDSI schools also included in the 2006 College Board Data Set.

**TABLE V: RETENTION RATES AT SEDSI COLLEGES AND UNIVERSITIES**

<b>SEDSI Participant School</b>	<b>Retention Rate</b>
Georgetown University	97
University of Georgia*	94
University of Florida*	94
Furman University	94
James Madison University	92
Virginia Tech*	89
University of Denver*	89
North Carolina State University	89
Clemson University	89
University of South Carolina*	86
Appalachian State University*	84
Presbyterian College	83
Virginia Commonwealth Univ.	82
Citadel*	82
Salisbury University	81
College of Charleston*	81
Winston-Salem State University*	80
St. Mary's University*	80
Millsaps College*	79
East Carolina University	79
Christopher Newport University	79
University of North Florida	78
High Point University*	78
Roanoke College*	77
Georgia Southern University	76
Abilene Christian University*	75
Winthrop University*	74
Randolph-Macon College	74
Radford University*	74
Savannah State University*	73
Pace University	73
Kennesaw State University	73
University of Memphis*	72
Frostburg State University*	72
East Tennessee State University	71
Liberty University*	70
Marymount University	68
Univ. of South Carolina- Aiken*	67
Francis Marion University	67
Lynchburg College	66
Georgia Southwestern University	65
Augusta State University *	65
South Carolina State University*	64
Allegany College	52
<b>Mean</b>	<b>77.9</b>

The same general conclusions that apply nationally also apply to this sub-sample, i.e., those schools ranked higher by rating sources have generally higher rates of student retention, and lower ranking schools have lower retention rates.

One potential application of the estimates from this paper is to compare the predicted retention rates for school in the sample with the actual retention rates. Such a comparison might suggest whether individual schools are performing as well as might be expected in terms of retention, given the other characteristics important in retention rates. To that end we offer Tables VI and VII with actual and predicted rates of retention for the SEDSI schools, with the predicted retention rates generated from the OLS estimates from Table III.

**TABLE VI: SEDSI SCHOOLS WITH GREATER THAN PREDICTED PERSISTENCE**

School	Retention Rate	Predicted Rate	Difference
Winston-Salem State University*	80	65.9	14.1
Savannah State University*	73	61.7	11.3
St. Mary's University*	80	69.8	10.2
James Madison University	92	82.7	9.3
Virginia Commonwealth University	82	74.0	8.0
High Point University*	78	70.9	7.1
University of Florida*	94	87.1	6.9
University of Georgia*	94	87.6	6.4
North Carolina State University	89	83.0	6.0
Salisbury University	81	75.9	5.1
East Carolina University	79	74.1	4.9
University of Denver*	89	85.0	4.0
Presbyterian College	83	80.2	2.8
Virginia Tech*	89	86.3	2.7
Appalachian State University*	84	81.5	2.5
Furman University	94	91.9	2.1
Clemson University	89	87.2	1.8
University of South Carolina*	86	84.4	1.6
Liberty University*	70	68.4	1.6
Georgia Southern University	76	74.7	1.3
Citadel*	82	80.9	1.1
Frostburg State University*	72	71.3	0.7
Francis Marion University	67	66.6	0.4
Augusta State University *	65	64.9	0.1
Radford University*	74	73.9	0.1

\*These schools did not report the percentage of students in good standing. That variable was estimated by regression.

Some of these differences are undoubtedly due to idiosyncratic differences across these schools. For example, schools differ with respect to religious affiliation, emphasis on sports, racial and gender make-up and other factors not captured in the regression equations. Of those schools that perform at lower than predicted retention rates, location and the associated economic environment may also play a role. It is possible to model some of these factors, e.g., religious

affiliation, single gender schools (this variable was included in preliminary regressions, but had no explanatory power), measures of rural/urban setting, and even the local economic environment are all possible candidates as explanatory variables in freshmen-to-sophomore retention.

**TABLE VII: SEDSI SCHOOLS WITH LESS THAN PREDICTED PERSISTENCE**

<b>School</b>	<b>Retention Rate</b>	<b>Predicted Rate</b>	<b>Difference</b>
South Carolina State University*	64	64.1	-0.1
University of North Florida	78	78.5	-0.5
East Tennessee State University	71	71.8	-0.8
Pace University	73	73.8	-0.8
Roanoke College*	77	77.8	-0.8
Georgetown University	97	98.0	-1.0
Marymount University	68	69.0	-1.0
Abilene Christian University*	75	76.7	-1.7
University of Memphis*	72	74.3	-2.3
Christopher Newport University	79	81.4	-2.4
Kennesaw State University	73	75.5	-2.5
Millsaps College*	79	81.7	-2.7
Georgia Southwestern University	65	68.8	-3.8
Univ. of South Carolina- Aiken*	67	70.9	-3.9
Winthrop University*	74	78.0	-4.0
College of Charleston*	81	86.1	-5.1
Randolph-Macon College	74	79.8	-5.8
Lynchburg College	66	76.3	-10.3
Allegany College	52	62.7	-10.7

\*These schools did not report the percentage of students in good standing. That variable was estimated by regression.

## FUTURE RESEARCH

The College Board Data Set includes the average freshman aid package. Though we have not yet attempted to incorporate this variable in the estimations of this paper, we plan to do so in the near future. We are also in the process of collecting data on individual school endowments. It is possible that these additional variables will improve the predictive power of these types of estimations. It would also be nice to know what happens with student aid between the freshman and sophomore years.

## CONCLUSIONS

The regressions in this paper indicate that many of the estimated effects of the explanatory variables are robust across different regressions. It is clear that institutions with higher SATs and higher tuition rates have higher rates of retention. Furthermore, greater percentages of freshmen in good standing and the higher percentages of freshmen housed on campus are also associated with higher retention rates. For given levels of the other explanatory variables, private schools have lower rates of retention than public schools.



Do the results detailed above yield any (modest) guidelines for college and university administrators and faculty who wish to increase rates of freshman-to-sophomore retention? It is clear that retention rates improve as the quality of the students that are attracted to the institution improves. Clearly then, if the student profile can be enhanced for a given institution, higher rates of retention should follow. A recommendation of this sort is not novel, (perhaps, not even valuable) since schools generally attempt to attract the most capable students possible, and the quality of students that schools see in the applicant pool is often pre-determined by other factors that are difficult to change.

Two possible policy implications seem to warrant emphasis. First, assuming that the percentage of faculty holding the PhD degree is a proxy for faculty quality (though this variable was only weakly significant), better faculty will likely increase rates of retention. It may follow that freshman students taught by the best faculty are more likely to be retained. (Of course any policy of this sort should be considered in terms of marginal benefits versus marginal costs.) Second, it is clear that grades (measured by the percentage of freshmen in good standing) matter in the aggregate retention rates among colleges and universities. Policies aimed at improving student performance at the freshman level may improve retention.

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## **HUMAN CAPITAL IN EASTERN EUROPE: DETERMINANTS OF STUDENT TEST SCORES**

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### **ABSTRACT**

This paper analyzes economic development in Bulgaria, Georgia, Latvia, Lithuania, Macedonia, Moldova, and Romania through Progress of International Reading Literacy Study (PIRLS) 2006 and statistics by the World Bank. This research rests on the assumption that students' family background is a more important determinant of educational outcome in free market economies than it is in communist societies. After grouping countries in two groups based on their PIRLS scores, this hypothesis is tested by the World Bank statistics. The conclusion suggests that Bulgaria, Georgia, Latvia, and Lithuania have succeeded in their educational reforms, whereas Macedonia, Moldova, and Romania still feature characteristics of communist societies.

### **INTRODUCTION**

Education is one of the most important determinants of economic growth because it is a "vehicle through which societal changes take place" [4] [1, p. 579]. This paper analyzes and compares the quality of education in seven Eastern European countries: Bulgaria, Georgia, Latvia, Lithuania, Macedonia, Moldova, and Romania. In particular, this paper illustrates that countries where students' family background play an important role in the educational outcome share the characteristics of free market economy, whereas countries where students' family background is a relatively unimportant determinant of test scores feature characteristics of communist societies. In other words, some countries achieve higher output with less input and this paper uses Progress in International Reading Literacy Study (PIRLS) test and the World Bank's Ease of Doing Business to test that claim.

This paper rests on the conclusion of Andreas Ammermueller's, Hans Heijke's, and Ludger Woessmann's 2003 paper titled "Schooling Quality in Eastern Europe: Educational Production during Transition," where they used middle school level test called Third International Mathematics and Science Study (TIMSS) to analyze the schooling in Eastern European countries. Ammermueller, Heijke, and Woessmann will be referred by the AHW acronym. Their research was conducted in 2003 and the countries that they examined were Czech Republic, Hungary, Slovenia, Slovakia, Lithuania, Latvia, and Romania. In 2003, none of the countries above were members of the European Union; Czech Republic, Hungary, Slovenia, Slovakia, Lithuania, and Latvia joined the EU in 2004 and Romania joined in 2007.

The main finding of their paper was that in some countries student background had greater effect on educational performance, while resources and institutional settings had much lower impact on the educational outcome (Ammermueller, Heijke, & Woessmann, 2005, p. 579). In conclusion, AHW divided the countries of their sample into two groups. They claimed that the relative importance of student background on the educational performance is a characteristic of free market economies and the countries where students' family background was a relatively important determinant of test scores have been successful in reforming their educational systems [1, p. 580]. Czech Republic, Hungary, Slovakia, and Slovenia were classified as countries of the Reform Group. However, in the countries of the Second Group, students' family background was relatively unimportant for the educational outcome. According to AHW, the countries of the Second Group including Romania, Latvia, and Lithuania had not shown a successful result of transition yet.

AHW also hypothesized that the countries of the Second Group displayed characteristics of communist societies [1, p. 579]. They claimed that in pseudo-egalitarian communist societies, party rank actually defines the social status as opposed to free market societies where educational level and income defines the social status. The main variables in terms of student family background that AHW used were parents' educational level, parents' attitude towards education, and stability of families. They also used resources and institutional setting variables to examine their countries.

The results revealed that in the Reform Group countries, student background had greater impact on tests scores, which moved them closer to free market economies of Western Europe [1, p. 580]. AHW stated that the reason why the Reform Group countries progressed further in transition was due to the fact that they have commenced their political and economic systems earlier in the 1990s, whereas in the Second Group countries political struggles delayed much of the needed reforms [1, p. 595].

It is notable that this paper uses different set of countries for sample than AHW paper to expand on some of their ideas. In addition to keeping Lithuania, Latvia, and Romania, Czech Republic, Hungary, Slovakia, and Slovenia are replaced by Bulgaria, Georgia, Macedonia, and Moldova. Due to the fact that one of biggest aims of this research is to contrast characteristics of communists and free market societies, it was appropriate to add two other post-Soviet countries, Georgia and Moldova, to the sample in order to illustrate how Georgia is making a successful transition towards becoming a free market economy. Macedonia was also added to the sample because it is also going through the transition after it became independent as a result of the breakup of Yugoslavia in 1993. Bulgaria was added to the sample as another country in Southeastern Europe to have a more diverse group of Eastern European countries in this research. However, another important criterion in selecting countries of the sample was the fact that all of them participated in PIRLS test in 2006.

While discussing the countries of the sample, it is important to mention that all of them share some economic similarities in the sense that the collapse of communist regimes in the early 1990s resulted in political instability and economic depression for most Eastern European countries [6]. In addition, some countries experienced armed conflicts which further promoted their economic instability. For example, Georgia fought a war in the early 1990s with two of its

separatist regions supported by Russia [8]. Following the economic instability of the early 1990s, most of these countries then entered a period of stagnation until the late 1990s [6]. Since the late 1990s, the economies of Eastern European countries became heavily depended on foreign investments because countries on both sides of the Iron Curtain started to take advantage of the business opportunities that were created for them since the fall of communism. For example, 3.6 billion U.S. dollar investment in the construction of Baku-Tbilisi-Ceyhan (BTC) oil pipeline has been the most important infrastructure project in the South Caucasian region [6].

Although high rates of foreign investments result in high rates of economic growth, the high rates of growth in transition countries must be accompanied by successful educational reforms, because their workforce must be ready to compete with highly skilled workers of Western European countries. If they develop highly skilled and educated workforce, they will be able to successfully compete with Western Europeans. But if they fail to reform their educational systems, they might face a danger of specializing in cheap labor and not sustaining their economic growth in the long run.

In the next two sections, this paper tries to establish a pattern in order to separate the countries of the sample in two groups, the Reform Group and the Second Group. Then in the subsequent section, the hypothesis formed in the second and third sections is tested by the World Bank statistics. Major variable used in analyzing PIRLS 2006 data are parents' educational level, parents' attitude towards reading, parents' report of children's books at home in terms of students' family background, and number of hours taught reading – in terms of institutional settings.

### **PIRLS 2006 DATA**

Progress in International Reading Literacy Study (PIRLS) is a test by International Association for the Evaluation of Educational Achievement (IEA) and its main objective is to measure international reading literacy. The PIRLS 2006 was conducted in 40 countries of the world among the fourth graders. The PIRLS test emphasizes the importance of reading in today's information society [5]. Figure 1 shows the PIRLS 2006 average scale scores along with years of formal schooling, average age of students tested, and Human Development Index (HDI) for the sample countries.

According to 2006 PIRLS International Report, the international average for PIRLS 2006 is 500 [5, p. 67]. Bulgaria is the leader in terms of average scale score of 547, and then follows Latvia with 541, Lithuania with 537, Moldova with 500, Romania with 489, Georgia with 471, and Macedonia is at the end of the list with 442. Bulgaria, Latvia, Lithuania rank high in terms of human development, whereas Georgia, Macedonia, and Moldova rank in the middle. Figure 2 shows basic country characteristics such as the population size, area, population density, infant mortality rate, urban population and life expectancy. Romania is the largest country in the sample with 238 thousand square kilometers and 21.7 million people, while Macedonia is the smallest country with 26 thousand square kilometers and 2.1 million people.

**FIGURE 1**

<b>PIRLS 2006 Distribution of Reading Achievement</b>				
<b>Countries</b>	<b>Average Scale Score</b>	<b>Years of Formal Schooling</b>	<b>Average Age</b>	<b>Human Development Index</b>
Bulgaria	547	4	10.9	0.816
Latvia	541	4	11	0.845
Lithuania	537	4	10.7	0.857
<b>PIRLS Scale Average</b>	<b>500</b>			
Moldova, Rep. of	500	4	10.9	0.694
Romania	489	4	10.9	0.805
Georgia	471	4	10.1	0.743
Macedonia, Rep. of	442	4	10.6	0.796

[5, p. 37]

Bulgaria and Lithuania are the most urbanized countries with 68% and 69% of urban population, respectively. The life expectancy ranges from 67 to 74 in the countries of the sample. Moldova has the lowest life expectancy of 67 years and Macedonia and Georgia have the highest of 74 years. However, Georgia has the highest infant mortality rate of 41, while Lithuania has the lowest of 8. Figure 3 lists the country characteristics such as Gross National Income (GNI), public expenditure on education as a percentage of GDP, net enrollment ratio in primary education, and primary pupil-teacher ratio.

**FIGURE 2**

<b>Selected Characteristics of PIRLS 2006 Countries</b>						
<b>Country Name</b>	<b>Population Size (in Millions)</b>	<b>Area of Country (1,000 Square Kilometers)</b>	<b>Population Density (Population per Square Kilometer)</b>	<b>Urban Population (% of Total)</b>	<b>Life Expectancy at Birth (Years)</b>	<b>Infant Mortality Rate (per 1,000 Live Births)</b>
Bulgaria	7.8	111	71	68	72	12
Georgia	5.1	70	74	57	74	41
Latvia	2.3	65	37	60	71	10
Lithuania	3.5	65	55	69	72	8
Macedonia, Rep. of	2.1	26	81	60	74	10
Moldova, Rep. of	4.2	34	129	42	67	26
Romania	21.7	238	95	56	70	18

[5, p. 26]

Latvia and Lithuania have the largest per capita GNI of 10,210 and 11,300 U.S. dollars, respectively. However, Georgia and Moldova have the lowest per capita GNI of 2,610 and 1,760 U.S. dollars, respectively. Public expenditures on education as percentages of GDP are the highest in Latvia and Lithuania with 6% and lowest in Georgia and Romania with 2% and 3%, respectively. Lithuania has the highest statistics in terms of primary enrollment ratio, where as many as 94% of children are enrolled in primary schools, when in Moldova 79% of children are enrolled in primary schools. Georgia and Latvia are the leaders in terms of pupil-teacher ratio

where a teacher is available for every 14 pupils, while Macedonia is at the end of the list with 21 pupils per teacher.

**FIGURE 3**

<b>Selected Characteristics of PIRLS 2006 Countries (Continued)</b>					
<b>Country Name</b>	<b>Gross National Income per Capita (in US Dollars)</b>	<b>GNI Per Capita (Purchasing Power Parity)</b>	<b>Public Expenditures on Education (% of GDP)</b>	<b>Net Enrollment Ratio in Primary Education (% of relevant group)</b>	<b>Primary Pupil-Teacher Ratio</b>
Bulgaria	2130	7540	4.0	90	17
Georgia	770	2610	2.0	89	14
Latvia	4400	10210	6.0	88	14
Lithuania	4500	11390	6.0	94	16
Macedonia, Rep. of	1980	6750	4.0	92	21
Moldova, Rep. of	590	1760	5.0	79	19
Romania	2260	7140	3.0	88	17

[5, p. 27]

The following figures will present data about student family background such as parents' educational level, parents' attitude towards reading, and parents' reports of children's books at home. According to AHW, in more reformed countries, students' family background is relatively important in explaining the test scores. Figure 4 lists the parents' education level for the sample countries.

**FIGURE 4**

<b>Selected Characteristics of PIRLS 2006 Countries (Continued)</b>						
<b>Countries</b>	<b>Finished University or Higher</b>		<b>Finished Post-Secondary Education but Not University</b>		<b>Finished Upper-Secondary School</b>	
	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>
Bulgaria	25	594	6	564	49	541
Georgia	48	498	24	459	25	441
Latvia	18	568	63	543	14	527
Lithuania	27	568	39	536	30	516
Macedonia, Rep. of	12	519	11	500	54	463
Moldova, Rep. of	20	529	35	505	2	
Romania	9	568	13	508	49	507

[5, p. 120]

In Bulgaria, Romania, and Macedonia most parent of children tested (49%, 49%, and 54%, respectively) have finished upper-secondary school. In Latvia and Lithuania most parents' of children tested (63% and 39%, respectively) have finished post secondary education but do not have college degrees. However, in Georgia the most of parents of children tested (48%) have college degrees. Figure 5 provides information about parents' attitudes towards reading.

**FIGURE 5**

<b>Selected Characteristics of PIRLS 2006 Countries (Continued)</b>						
<b>Countries</b>	<b>High PATR</b>		<b>Medium PATR</b>		<b>Low PATR</b>	
	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>
Bulgaria	44	573	37	535	18	535
Georgia	41	488	54	466	5	432
Latvia	57	551	37	535	6	524
Lithuania	51	549	43	529	6	524
Macedonia, Rep. of	54	479	42	419	3	405
Moldova, Rep. of	34	514	59	495	7	481
Romania	38	528	48	479	14	428

[5, p. 131]

In Latvia, Macedonia, Lithuania, and Bulgaria, most parents have high attitude towards readings (57%, 54%, 51%, and 44%, respectively). On the other hand, in Georgia, Romania, and Moldova most parents have medium attitude towards reading (54%, 48%, and 59% respectively). The parents' attitude towards reading statistic is also a variable of student background because parents can play an important role in encouraging or discouraging their children to become educated. Figure 6 shows another family background variable, parents' reports of children's books at home. 13% of parents in Latvia have more than 100 children's books at home. In Lithuania and Bulgaria, 5% of parents have more than 100 children's books at home, in Georgia and Macedonia - 4%, in Romania - 3%, and Moldova - 2%.

**FIGURE 6**

<b>Selected Characteristics of PIRLS 2006 Countries (Continued)</b>						
<b>Countries</b>	<b>More than 100 Books</b>		<b>51 - 100 Books</b>		<b>26 - 51 Books</b>	
	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>
Bulgaria	5	606	11	590	24	571
Georgia	4	510	8	500	21	489
Latvia	13	571	21	559	31	544
Lithuania	5	570	14	564	28	546
Macedonia, Rep. of	4	464	9	472	27	478
Moldova, Rep. of	2		5	529	16	523
Romania	3	559	9	548	20	531

[5, p. 131]

According to AHW, institutional settings do not play a major role in the educational outcome in free market societies. Figure 7 shows the number of hours students are taught reading per week. In Romania, 54% of students are taught reading more than 6 hours per week. In Moldova 50% of

students are taught reading more than 6 hours per week, in Bulgaria – 46%, in Lithuania – 39%, Georgia – 33%, Latvia – 22%, and Macedonia – 17%.

**FIGURE 7**

<b>Selected Characteristics of PIRLS 2006 Countries (Continued)</b>						
<b>Countries</b>	<b>More Than 6</b>		<b>More Than 3 Up to and Including 6</b>		<b>Up to and Including 3</b>	
	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>	<b>Percent of Students</b>	<b>Average Achievement</b>
Bulgaria	54	494	33	543	21	548
Georgia	33	467	28	475	39	472
Latvia	22	546	27	535	50	540
Lithuania	39	539	31	538	30	537
Macedonia, Rep. of	17	429	33	432	50	460
Moldova, Rep. of	50	503	30	499	20	487
Romania	54	494	26	493	20	473

[5, p. 182]

### **QUALITATIVE REVIEW OF PIRLS 2006**

The goal of this section is to find the pattern in order to separate the countries into two groups similarly with the AHW paper. The Reform Group will combine the countries where students' family background plays a relatively important role in the educational outcome, whereas in the Second Group family background is not directly related to the educational outcome. The method employed in this section is descriptive and it is not based on regression analysis. In order to make the analysis more rigorous, the hypothesis formed in this section will be tested by the World Bank statistics in the subsequent section.

First, parents' educational level will be considered as a variable for family background. Moldova and Latvia stand out in analyzing the parents' educational level variable in the sense that in Moldova 20% of children whose parents have a college degree averaged 529 in PIRLS 2006, whereas 18% of children in Latvia whose parents have a college degree averaged 568. This means that Latvia achieved higher output (568) with less input (18%). Therefore, we can place Latvia in the Reform Group and Moldova in the Second Group.

Another important variable to consider is parents' attitude towards reading. The basic assumption is if parents have high attitude towards reading, their children are likely to do well on the reading tests. For example, in Bulgaria 44% of parents have high attitude towards reading, and their children averaged 573, which is greater than Macedonia's 478 average where as much as 54% of parents have high attitude towards learning. This suggests that parent's attitude is an important determinant of test scores in Bulgaria but does not appear to be as strong in Macedonia. Therefore, this example also suggests that Bulgaria can be placed in the Reform Group.



The last variable addressed in terms of students' family background is the availability of books at home. Republic of Georgia and Macedonia stand out in this case because in Georgia 4% of parents have more than 100 children's books at home, and their children averaged 510, more than the international average of (500). On the other hand, in Macedonia 4% of parents also have more than 100 children's books at home but their children averaged 464 in 2006 PIRLS, which is below the international average (500). This suggests that the availability of children's books at home is more important determinant of the educational outcome in Georgia than it is in Macedonia. Therefore, according to this reasoning, Georgia can be placed in the Reform Group countries and Macedonia in the Second Group.

Since AHW concluded that institutional settings have much lower impact on the educational outcome, it is important to analyze institutional settings in this section. For instance, one can mention the number of hours reading is taught per week as an example of institutional settings. According to Figure 7, in Romania 54% of children are taught reading more than 6 hours per week but they averaged 494 in PIRLS 2006, which is lower than Lithuania's 537, where only 39% of children are taught reading more than 6 hours per week. This implies that Romania is not able to achieve a higher educational outcome despite its higher input. Therefore, Romania is placed in the Second Group, whereas Lithuania is placed in the Reform Group.

In summary, this section hypothesized that Bulgaria, Latvia, Lithuania, and Georgia belong to the Reform Group because their educational systems reflect free market societies in the sense that students' family background plays an important role in educational outcome. The Second Group consists of Macedonia, Moldova, and Romania, where family background does not play a major role in the educational outcome. Due to the fact that this section derived its hypothesis by illustrating comparisons of two countries at a time, the first hypothesis will be tested by the World Bank statistics to evaluate the strength of the distinction between the Reform Group and the Second Group.

## **WORLD BANK DATA**

The goal of this section is to test the hypothesis formed in the previous section that Bulgaria, Georgia, Latvia, and Lithuania characterize free market economies more than Macedonia, Moldova, and Romania. In order to illustrate this difference between the Reform Group and the Second Group, one can use the Ease of Doing Business rank by the World Bank. The Ease of Doing Business is one of the most popular ranks by the World Bank Group. It is a combination of ten different variables that measure business friendliness. The variables that make up the Ease of Doing Business rank are starting a business, dealing with licenses, hiring and firing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts, and closing a business.

In the overall rank of the sample countries, Georgia is the leader as #18 in terms of ease of doing business. Latvia follows at #22, then Lithuania - #26, Bulgaria - #46, Romania - #48, Macedonia - #75, and Moldova - #92. All of the countries that were placed in the Reform Group (Bulgaria, Georgia, Latvia, and Lithuania) rank higher than the countries placed in the Second Group (Macedonia, Moldova, and Romania). Thus, the Ease of Doing Businesses rank strongly supports the hypothesis that Reform Group countries have liberal state characteristics.

## CONCLUSION

As expected from the hypothesis, the Reform Group - Bulgaria, Georgia, Latvia, Lithuania – where students' family background is an important determinant of PIRLS 2006 test scores, shows more characteristics of free market economy than the Second Group. The Second Group countries share the same characteristic that students' family background does not affect as much the educational outcome, which according to AHW is a characteristic of communist societies. This research paper illustrated that the Second Group countries also lack business friendliness. This yields that the Reform Group countries have successfully reformed their educational systems which will help them compete with skilled workers from other parts of Europe.

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# **A SWOT ANALYSIS OF MEDICAL TOURISM IN SOUTHEAST ASIA**

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## **INTRODUCTION & BACKGROUND**

According to the US Census Bureau, over 46 million Americans were uninsured in 2005 (DeNavas-Walt & Proctor & Lee 2006). Combined with this dramatic level of uninsured patients, healthcare spending is projected to exceed \$4.1 trillion by 2016 (Centers for Medicare and Medicaid Services 2006). A study by the World Bank finds that health care quality in many developing countries is “above the minimum acceptable standards in industrial countries” (Mattoo & Rathindran 2005). Rising healthcare costs along with staggering figures of the number of uninsured is making employers and employees begin to think about medical services provided by foreign countries, which have lower cost along with good reputation.

In service sector, the concept of medical tourism is catching up at lightning speed across the world. Cortez (2007) also argues that healthcare services are one of the most “rapidly growing markets in the world”. The growing trend of medical tourism is not merely seen on an individual patient basis, many corporations are also investigating the potential benefits. Marlowe and Sullivan (2007) find that some employer-sponsored insurance plans are comparing the cost savings of offshore healthcare with the unknown risks of treatment abroad. Chandra (2002) also finds that US insurance companies are also increasing the level of outsourcing of medical claims processing

and even diagnostic test interpretations. Mattoo and Rathindran (2005) summarized how different health insurance plans in the US treat health care received overseas. Some cover health care received abroad, while others do not, but in general there is a growing trend. They believe that whether patients travel abroad for health care depends on the coverage of treatments by their health insurance plan. The insurers can be regarded as one of the service providers. If they make some adjustment and cover the cost of treatment abroad in their health insurance plan, people are more likely to pursue medical services abroad. The question is what will they gain from the trade? For just 15 highly tradable, low-risk treatments, the annual savings to the US would be \$1.4 billion even if only one in ten patients who need these treatments went abroad. Half of these annual savings would accrue to the Medicare program alone (Mattoo & Rathindran 2005).

The state of health care of the host nation can affect its medical tourism industry in two ways. First, tourists assess a potential destination based on its track record in providing a healthy environment to visitors (Page, 2008). Hence, a high occurrence of accidents, injuries and health related issues can adversely affect the experience or perception of tourists, which in turn negatively impacts the tourism demands for a destination. Second, a number of governments have sought to develop medical tourism to enhance further their tourism industries, believing such efforts can increase both number of tourists and tourist revenues (Lee 2009). Based on the above arguments, many people consider some developing countries in Asia as good medical tourism destinations. On the one hand, these countries have good reputation on specific medical

surgeries, which attract foreign medical tourists. On the other hand, the governments of these countries provide policies to medical tourism industry in order to boom their economy. Foreign medical tourist can benefit from these policies from cost saving's perspective.

There are some issues, however. The US healthcare system provides patients with patient protection through the HIPAA of 1996 (Health Insurance Portability and Accountability Act). Marlowe and Sullivan (2007) point out that the stringent HIPAA laws apply in the US and US based health plans must follow these rules, even for service providers in another country. They recommend that patients consider whether HIPAA business associate agreements are in place between US health plan and the foreign vendor.

Given that there are large gains from trade in health care, what are the reasons for insurers to deny coverage for non-emergency treatment obtained abroad rather than encourage patients to seek care overseas? Insurer have concerns the quality of overseas providers and malpractice law, the cost of monitoring health care consumption abroad, institutional impediments, as well as distorted incentives in oligopolistic markets (Mattoo & Rathindran 2005). Thus there are many pros and cons to medical tourism as witnessed by the people seeking treatment and the insurance companies. In this paper, the author looks at the medical tourism industry in select regions of Asia through a SWOT analysis with the hope to capture some of the existing and emerging positive trends and to shed light on some of the problem areas in this industry. SWOT Analysis is a strategic planning method used to evaluate the Strengths, Weaknesses,

Opportunities, and Threats involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective.

Medical tourism is a growing trend in South East Asia. India has been a front runner in this area but other countries are also capitalizing on the growing number of available opportunities. A country that is rapidly growing its medical tourism business industry is South Korea. Several factors come into play when one thinks about medical tourism. Government support is arguable the single largest factor, but one cannot ignore areas such as infrastructure in terms of hospitals and travel, competence of medical staff, business acumen and entrepreneurial drive of the middlemen facilitating the process and the general reputation of the host country especially from the point of view of its political stability. The SWOT analysis for Asian markets in this paper is focused on certain regions that are of interest. Often, frequent references of India and South Korea will be found throughout the paper and with good reason. India, as noted previously represents a well established medical tourism market whereas South Korea represents an emerging market. The objective is to understand the various positive and negative factors that can help or hurt the growth of the medical tourism business in markets represented by these nations.

## **A SWOT ANALYSIS OF MEDICAL TOURISM IN SOUTHEAST ASIA**

### **Strengths:**

#### 1) Affordable Medical Cost

If we look at India, we can see that it has several inherent capacities that led to its

success in the medical tourism industry. It has price advantage which is a good selling point. In India, the cost of complicated surgical procedures is 1/10<sup>th</sup> as compared with the procedures in the developed countries. India provides medical services with lower cost also people don't need to wait many months before they can get the surgery. The reduced wait time is an advantage not just limited to India but to all Asian markets. For those who are willing to pay, service is available without delay. The following table compares the different average costs of specific treatments between India and other major healthcare destinations.

Table 1- Cost Comparison between India, USA & UK

Nature of Treatment	Cost in India (\$)	Cost in other major healthcare destinations (\$)	Waiting periods in USA/UK (months)
Open heart surgery	4,500	>18,000	9-11
Cranio-facial surgery	4,300	>13,000	6-8
Neuro-surgery with hypothermia	6,500	>21,000	12-14
Complex spine surgery with implants	4,300	>13,000	9-11
Simple spine surgery	2,100	>6,500	9-11
Simple brain tumor	1,000	>4,300	6-8
Biopsy	4,300	>10,000	6-8
Hip replacement	4,300	>13,000	9-11

Source: The Guradian News, Feb 1, 2005

Three primary reasons for the large cost discrepancies between the United States and India (one of the major players in the multibillion dollar medical tourism industry) are: lower labor costs, no malpractice costs, and lower pharmaceutical costs (Forgione & Smith 2007). According to the Centers for Medicare & Medicaid Services, more than 70 percent of hospital costs within the United States are labor related (Mattoo & Rathindran 2005). On the other hand, the cost structure in South Korea is comparatively higher and this points out to a disparity in costs within Asia. Though all Asian countries will offer medical services at lower costs than most western nations, there are

discrepancies in pricing among Asian nations.

## 2) Accreditation:

Accreditation of hospitals is a vital factor when evaluating the quality of care issue. The Joint Commission International (JCI) is the premier standards-setting and accrediting body in health care within the United States. Many hospitals in Southeast Asia countries received JCI as shown in table 2.

Table 2- JCI Accredited Organizations in Southeast Asia

<b>Country</b>	<b>Number of hospitals accredited by JCI</b>
Singapore	11
India	6
Thailand	2
Philippines	2
Taiwan	2

Source: [www.jointcommissioninternational.org](http://www.jointcommissioninternational.org)

Thus, countries which have hospitals that are accredited show parity in quality to the west. This helps the nation as a whole. If we see that Singapore has the highest number of hospitals that are accredited, we are more likely to perceive that it is country with well developed health care systems and infrastructure. One might even be more inclined to go to a non accredited JCI hospital in a country that has a large number of accredited hospitals.

## 3) Language Competency:

Many Southeast Asia countries speak English. India was under British rule for several years and this contributed to the English language competency of its people. This is a large advantage when it comes to communication skills of its entrepreneurs who established the medical tourism business and also helped marketability of physicians and support staff. South Korea has benefited from the Seoul Olympics and



its global acceptance as a strong economy. Though the medical tourism industry is relatively new, in general, several western countries have well established trade relations with the South Korea. The English language competency has been developing rapidly in South Korea and this helps develop and promote the medical tourism industry as well. Other nations such as Singapore have a large English speaking population as well. We find countries such as Vietnam, Cambodia, Laos and to some degree even China struggling in the area of language competency. As the medical tourism gets rapidly globalized and with the increased strong hold of other languages-particularly Spanish, often promotion of the business in several other languages is worthwhile. South Korea has opened one-stop service center for medical travelers like establishing of information booths and medical information website in five languages.

#### 4) Government support through favorable policy

Some countries and localities view inbound medical tourism from the West as a solid opportunity for economic development and use tax policies to encourage the development of major medical tourism destinations. South Korea, Dubai and others have recently announced major efforts; some Caribbean islands have stepped-up offerings, including establishing official offices of medical tourism. Governments are positioning themselves to play an increasingly important role in the growth of medical tourism. South Korea's government has allowed foreign investors (individual and institutional) to operate hospitals in the country's free economic zones (FEZs). India also has encouraged the medical tourism industry. With the rapid deregulation of the

nation and favorable tax laws being passed to encourage entrepreneurs, the medical tourism industry has really blossomed in India. As in other nations, there are special incentives and policies in place to encourage medical tourism as it provides a welcome source of foreign revenue.

**Weakness:**

The strengths that were discussed in the previous section automatically become weaknesses for countries that are poor or incompetent in the respective areas. We however, look at some independent systemic weaknesses inherent to the Asian medical tourism industry.

1) Lack of Accountability

In western countries there is a lot of value placed on the value of human life and its protection. There are penalties and methods for recourse for the wrongful death and/or injury to a patient receiving medical treatment. The legal system is clear and transparent that allows for equitable distribution of the laws and demands accountability. A major drawback is that in several Asian countries, there is little accountability when things go wrong during treatment and medical procedures performed in these countries. There are no sound legal systems protecting patient rights and the few that exist are very poorly implemented. Corruption, high power distance and informality often are marked cultural mainstays of Asian countries and these prove to be disadvantageous when it comes to the health care scenario as well. In general, good mechanisms to manage complaints from patients do not exist. For instance, India- the leader in medical tourism in Asia doesn't have well-established malpractice laws.

Proving doctor negligence in India is quite difficult due to legal red tape, corruption and hospitals' incompetence to manage complaints from patients (Mudur 2000).

## 2) Poor Infrastructure:

Infrastructure is another problem. For instance, in India, patients have to change three or four flights to reach their destination of choice. The public transport system and the roadways are often not up to the mark. The infrastructure problems are not limited to transportation. Several hospitals are quite poorly equipped in terms of their diagnostic equipment which is often old and outdated. It is difficult to gauge the quality of the hospital based on internet photos. With the increasing number of medical tourism providers advertising on the internet, there is a decline in quality. Not all medical procedures are done at the premier hospitals as used to be the case in the past. Nowadays, there is a lot of competition around cost and quality is often compromised. Several medical tourism businesses have cropped up-each touting itself as offering state of the art facilities and treatment. This is simply not possible and such faulty advertising and marketing is leading to more unpleasant experiences for the foreign patients.

## 3) Cost disparity:

This can be a source of strength or weakness depending on which country one belongs to. In South Korea, a common problem we see is that the cost is often inconsistent among procedures. For example, there is a lot of popularity around cosmetic surgery in South Korea and this is a very expensive procedure whereas other procedures are quite inexpensive. Such unique supply-demand nuances exist and these

are difficult to capture in the overall medical tourism model for each nation. Similarly, in India almost all services are uniformly lower priced than those of its competitors and this is the main reason why it is still considered a premier destination.

**Opportunity:**

The Asia medical tourism industry has been growing with a double digit CAGR (Compound Annual Growth Rate) and expected to reach US\$ 8.5 Billion by 2013. Thailand and India vie with each other for the medical tourism crown. Thailand's prices are a bit higher on average than India's, however Thailand capitalized on the opportunities that the western traveler would be willing to pay a little more to a good overall tourist experience as long as the price is still substantially lower than the parent nation. Thailand and South Korea have also capitalized on the opportunity of increasing revenue and achieving higher customer satisfaction through bundling of services. In 2008 Thailand has treated the highest number of international patients compared to any other Asian countries.

The medical tourism industry is growing very well under government's support in Southeast Asia countries. The market share increases every year. Improved domestic and international IT connectivity would bring more and more medical tourist arrivals. Preventive health checkups and alternative treatments such as specialized herbal medicines, medicinal massages etc are areas that can be developed. Another opportunity is that people need not only go specifically to a country for the main purpose of treatment. Several diasporas from Asia often visit their countries for vacation. Procedures such as dental checkups and cleanings, general physical checkups,

eye exams etc are something they can avail of during their visits and this represents a largely unexplored area of the medical tourism industry. Entry of multinationals and private funding would boost the status of medical tourism industry. In fact, many multinational companies can have their Human Resource departments find out about the cost of health care and see the cost benefit of allowing western employees to receive treatment in Asian countries. Last but not the least point is the macroeconomic environment such as the development of GDP growth and steady foreign exchange rate in Southeast Asia countries. As Asian countries develop at a rapid pace in light of globalization, as long as they maintain favorable currency exchange rates and relatively lower cost of health care, the opportunities will abound.

The opportunity is not limited to just the parent nation-the host nation has benefits also in terms of higher pay and better working environments for health care providers. Demand tends to overpower supply due to the specialized nature of health care. High population density countries such as India tend to supply a lot of doctors and nurses globally and many of them would appreciate the opportunity to work in their own countries for higher pay. This is made possible by the higher profit margins that can be availed through the medical tourism. For instance, the average price of rhinoplasty for an Indian native is around \$500, whereas through the medical tourism industry the package starts at around \$1500. To some degree there is inelastic price elasticity of demand as well and it would be very difficult for western countries to compete with the cost structures of Asia. Thus, the regional and currency advantages are worth sources of opportunities by which Asian countries can grow the industry. A lot of very skilled

people such as doctors, nurses and other therapists are needed in providing quality medical care. Often, medical tourism companies set up their own hospitals that are high end and this can offer good career and growth opportunities. This can also be a welcome opportunity for western trained doctors to return to their home country. We know that several physicians in the US are of Indian origin and some may want to return to India. A forward thinking medical tourism company would try to recruit them and they could then market and capitalize on this superiority as they have physicians trained in US medical schools.

There is also growing prosperity within Asian countries. Thus, poorer nations can look to develop the medical tourism industry to richer nations within Asian. This can be a source of new markets for medical tourism. For example, Malaysia is concentrating on neighboring countries like Indonesia and Singapore for its growth going forward. The international patient arrivals to Malaysia are expected to grow with a CAGR of 29.27 percent for the period of 2009 to 2013.

**Threats:**

As saturation occurs and competition increases, the lack of investment towards medical tourism from the point of view of both the entrepreneur and the governments may be the potential problem. Since Southeast Asian countries have similar advantages, the competition is often fierce and some nations are not as successful as others. Marketing the differentiated advantages for each country deserves to be paid attention to; otherwise, some of the countries will lose out in wake of extreme competition.

Countries such as Thailand and India are considered the front runners in the

medical tourism in Asia, but they are getting tough competition from other Asian countries like Philippines, Singapore, Malaysia and South Korea. All these competitors have government-backed medical tourism programs and are trying to catch up fast. Singapore, which is a modern nation with developed infrastructure, is a major threat to other nations. It is planning to be developed into a leading health care destination in Asia with its medical tourism market steady growth of 11.9 percent over the past few years (2004 to 2008). Also, South Korea is planning to develop an island into a healthcare hub with all the latest healthcare facilities by 2011. The island will be a two-hour flight from five major Asian cities Seoul, Beijing, Shanghai, Hong Kong and Tokyo.

Another potential threat is the dependency on the western countries. The medical tourism industry stemmed from the high cost of health care in the western countries. The US health care system has very high cost structure associated with it. Furthermore, the policies around health care are complicated and elective procedures are not covered under public and private medical programs. Similarly, the Canadian health care system, while socialistic and free from cost burdens, suffers from long wait times for procedures. Currently, there is a lot of health care reform that is ongoing. Several laws and bills are being proposed and the government recently passed the Comprehensive Healthcare Reform Bill. The changes in the health care structure in the west can often have a sizeable influence on the medical tourism industry. If there are changes in the western health care policies that make medical treatment more affordable and accessible, then fewer people will want to avail of services in the west.

The medical tourism is also affected by the general economic downturn. Often, medical tourism for elective and cosmetic procedures, which represents a sizable chunk of the industry, is still considered a discretionary spending item for most people. The current unfavorable global economic climate poses a sizeable threat to the medical tourism industry.

## **CONCLUSION**

Medical tourism is not without challenges; but the industry is still young. Hospitals in developing countries which target foreign patients should seek to meet or exceed western standards and expectations if they are to compete. The SWOT analysis makes certain points clear. It shows that there while there are several advantages, most of the industry hinges on the cost saving for the insurance companies and the private institutions. We also see how the main issues revolve around the issues of lack of accountability and poorer quality and infrastructure. When we look at the opportunities we find that several abound in the areas of developing new markets-particularly among Asia and also offering non emergent, preventive and alternative care to people who visit their home countries for recreational purposes. Using the human resource departments of the multinational companies located in Asian countries can help develop cost saving policies for organizations and aid negotiations with insurance companies. These opportunities however need to be juxtaposed with the threats that the industry faces. As in any successful industry, competition is to be expected and the medical tourism industry has its fair share of the same. With several countries trying to capitalize on the ever increasing size of the pie, it is likely that not all countries will succeed. Only those



with improved infrastructure, sound long term strategies and innovative offerings will be able to maintain sustained growth.

A lot of research needs to be done to explore each independent component of the four components of the SWOT analysis. Obtaining data is difficult and conducting field research is challenging. Also, a lot of the medical tourism industry is run through middlemen and is largely unorganized and a lot of the available data is obsolete as the industry continues to evolve at a rapid pace. These are some of the limitations leading to difficulties in conducting sound research. However, as a growing number of journals and publications show continued interest in this area, better research will be forthcoming. This paper merely probes some of the emerging trends in the industry and offers some perspectives on how competitive advantage can be sustained.

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## **The First Ten Years of the Euro and Beyond**

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## Abstract

Ten years have already passed since the establishment of the Economic and Monetary Union (EMU) in eleven European Union countries that adopted the single European currency, the Euro, on January 1, 1999. Presently, 16 European countries have adopted the Euro. All EMU countries, as a result, have surrendered their independent monetary and exchange rate policies.

Based on numerous statistical reports and studies, the EMU has so far delivered an amazing performance. Most countries gained substantial benefits in the form of price stability and low interest rates. This study examines the establishment of the EMU from the historical perspective. It begins with all those events after the end of WW II that contributed to European unification. Economic integration in Europe prevented wars on the European continent. Furthermore, economic integration led to political stability and growth. Monetary integration was a logically necessary extension complementing economic integration to safeguard and enhance the benefits of economic integration.

The present financial mortgage crisis was a setback for the European economies, and its effects are far from over. It can, however, serve as a constant reminder that unless the EMU countries adopt a common fiscal policy, they will always be vulnerable to possible reoccurring shocks.

This paper takes an intuitive approach to explain the dollar-Euro exchange rate. For this reason, it focuses on what is known as economic fundamentals. Not surprisingly, the macro-economic structure of the US economy has an important influence on the dollars-Euro exchange rate. The US trade deficit plays a crucial role in influencing the Euro exchange rate. The most important variable, however, is the real interest rate differential between the US and the countries that adopted the Euro, known as Euro Area (EA) or Eurozone.

## 1. Introduction

More than ten years have passed since the establishment of the EMU from January 1999 when the Euro was first introduced, replacing the currencies of 11 EU countries.<sup>1</sup> The Euro was first introduced only as an electronic currency in the form of demand deposits (checking accounts) and as savings accounts. On January 1, 2002, the Euro also circulated in the form of coins and banknotes in 12 EU countries in parallel with the national currencies that were withdrawn within two months.<sup>2</sup> This was the largest withdrawal and replacement of national currencies in the world's monetary history. Some 660 billion Euro coins and banknotes were produced and distributed in the twelve Euro Area countries. Enough banknotes were printed that if they were placed end-to-end, they would cover five times the distance from the Earth to the moon.<sup>3</sup> When in the late 1980s the European Community (EC) leaders began discussing the possibility of the formation of the EMU, many expressed skepticism for the success of the ambitious monetary project. It was then unimaginable to many Europeans that the EU countries would willingly trade, for a new and untested currency, their national currencies that were so familiar for so many years.

The skeptics came from all strata of life, including economists, academics, journalists, and many more. The popular press in the UK characterized the EMU project as a "jump in the dark," and reminiscent of the large bird with the same name (EMU) that cannot fly, thus they prophesized the Euro's failure. Critics of the EMU argued that the total costs to the EC from the formation of the EMU outweigh the benefits. However, only a small group of countries, such as Germany, Belgium, Netherlands, Luxembourg, France, and possibly Denmark, constitute an Optimum Currency Area (OCA), implying that only these countries qualify for EMU membership. A new era of European integration, despite the reservations, began on January 1999 as eleven sovereign EU countries surrendered their independent monetary and exchange rate policies to a central European authority.

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<sup>1</sup> Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain are the first eleven countries that formed the EMU.

<sup>2</sup> Greece joined the EMU on January 1, 2001.

<sup>3</sup> See Blitz, J. "Eurozone Gives Thumbs Up to New Currency," *Financial Times Weekend*, January 5-6, 2002.

Ten years after its introduction, the Euro has prevailed; most believe that the Euro is here to stay. The Euro is presently the second most important currency after the dollar used as an international reserve currency. It is employed widely in financing trade and investment, and it is increasingly used by corporations, international organizations, and governments to raise capital through issuing bonds. Prior to the establishment of the EMU, economists argued that a true test for the survival of the Euro will be the time when the EA experiences its first major asymmetric shock. The main reason for this claim by economists is that the loss of exchange rate policy and the adoption of the common monetary policy with one interest rate for all countries will make some countries vulnerable to asymmetric shocks. The present subprime mortgage financial crisis, notwithstanding, affected all EU countries, its effects, however, are asymmetric. Starting the last quarter of 2008, the sovereign debt of a few EA countries was differentiated by credit rating agencies as they were perceived not having their public finances in order. Interest rates, for this small group of EA countries on the ten-year government bond, increased because of added liquidity and risk premia in relation to the interest rates of the ten year government German bonds. Germany, as the largest and most fiscally disciplined country in the EU, is one of the EA countries with the lowest long-term interest rates. The ability of the countries to finance their sovereign debt successfully during the financial crisis may constitute the ultimate test for the EMU and the Euro.

As for the rest of the paper, Section 2 provides a historical overview of the events that led to the formation of the EMU. Section 3 discusses the Maastricht Treaty that established the EMU; the economic fundamentals determining dollar/Euro exchange rate are discussed in Section 4. Section 5 employs a diagrammatic analysis to explain the dollar/Euro exchange rate determination. The international role of the Euro is discussed in Section 6. Lastly, Section 7 elaborates on the future of the Euro and concludes the paper.

## 2. A Historical Monetary Overview Prior to the Formation of the EMU

European monetary integration, according to many analysts, can be explained as a necessary and logical extension to ongoing European integration. Economic integration in Europe has been a long process. It began with the Marshall Plan and the formation of the Organization of European Economic Cooperation (OEEC) after the end of WWII for the purpose of distributing US aid to Western European countries. The establishment of the European Coal and Steel Community (ECSC) with the Treaty of Paris (1951), and the European Economic Community (EEC) with the Treaty of Rome (1957), along with the European Atomic Energy Community (EURATOM) constitute the undisputed historical hallmarks that permanently molded the future shape of modern Europe. Not only have the two treaties solidified permanent peace among the belligerent European countries, but they also opened the path to unification of Europe through economic and monetary integration. The establishment of a free trade area, a customs union, and a common market with the Treaty of Rome created an environment of free trade for goods, services, and free mobility of factors of production. With the 1967 Merger Treaty, the three communities merged into one entity that came to be known as European Community (EC), a name that is presently used.<sup>4</sup>

The first serious effort for monetary integration began with 1969 summit of the EC leaders in Brussels, when they decided to form a committee chaired by the prime-minister of Luxembourg, Pierre Werner, to investigate the possibility of the monetary union creation. The Werner Committee reported in the following year that a monetary union is feasible and can be established in three stages within ten years by the year 1980. Several adverse events, however, forced the EC countries to postpone the ambitious

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<sup>4</sup> The ECSC, the EEC, and EURATOM were launched by six countries, Belgium, France, Germany, Italy, Netherlands, and Luxembourg. Denmark, Ireland, and the UK gained membership in 1973. Greece joined in 1981, whereas Portugal and Spain joined in 1986, followed by Sweden, Finland, and Austria, which joined in 1995. This northern enlargement resulted in EC15. In 2004, ten more countries, Malta, Cyprus, Slovenia, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, and Hungary, joined the EC, increasing the number of countries to 25. Lastly, in 2007 Bulgaria and Romania joined, increasing the number of EC members to 27. The 2004 and 2007 enlargements permanently and drastically altered the future of the European continent, when ten Central and Eastern European former communist countries joined the EC.

project. Major factors, which contributed to the postponement of the project were the 1973-74 oil crisis and the collapse of the Bretton-Woods international monetary system in 1973 that caused price instability and the large exchange rate fluctuations.<sup>5</sup>

The most serious effort of European monetary integration began when a group of EC countries established the European Monetary System (EMS) in 1979. This was a less ambitious monetary program, than the formation of a complete Monetary Union. The EMS was envisioned by the German chancellor Helmut Schmidt and the French president Valery Giscard D'Estaig, who along with the then EC Commission President Roy Jenkins were determined to establish a system of monetary and exchange rate stability within the EC countries.

The EMS consisted of three main components: 1) the Exchange Rate Mechanism (ERM), 2) the European Currency Unit (ECU), and 3) the European Monetary Cooperation Fund (EMCF). According to the ERM provisions, all countries' currencies were allowed to fluctuate within a +/- 2.25 percent band against each other and against the ECU. The ECU was a weighted average of all EMS member countries' currencies. It was an accounting currency unit used mainly for transactions between the EC Institutions and member countries. It was, however, destined that the ECU would evolve into a full-fledged currency, the Euro. The EMCF was created from contributions of the EMU countries to assist those EMS members experiencing balance of payments and exchange rate difficulties. The EMS lasted 20 years until it was replaced by the EMU in 1999. The EMS was a successful monetary program as it substantially increased exchange rate stability, and enhanced trade among the EMS member countries.

Although the EMS served its members well during the two decades, except the 1992-93 period of the exchange rate crisis, EC leaders were determined to more rigorously pursue monetary integration, aiming

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<sup>5</sup> Most of the provisions of the Werner plan, nonetheless, reappeared in future monetary program proposals that were adopted by the EC countries promoting European monetary integration. For this reason, Pierre Werner's proposed monetary plan gained him the title of Mr. Euro.



for nothing short of a complete economic and monetary union. Many authors who closely studied European integration realized that the formation of a complete monetary union was necessary after the EC countries adopted the Single European Act (SEA), which established the Single European Market (SEM) by the end of 1992. The SEM introduced free capital mobility among EC member countries. Free capital mobility is considered one of the main causes of the 1992-93 exchange rate crisis, which had detrimental effects on the economies of most EMS member countries.

In June 1988, the European Council appointed the president of the EC Commission, Jacques Delors, to chair a committee for the purpose of investigating the feasibility of the formation of a complete monetary union. By the end of 1989, the committee submitted its report, which later became known as the Delors Report. The Delors committee echoed the Werner Plan, recommending the formation of a complete economic and monetary union in three stages. On December 1991, the EC leaders met at the Dutch town Maastricht where they agreed to establish an Economic and Monetary Union. The Maastricht Treaty was not signed by all the EC members in its entirety. Denmark and the UK were allowed to opt out of the EMU and thus given the option not to adopt the Euro. Sweden will eventually join the EMU as this country did not opt out, but purposefully had failed to meet all the Maastricht criteria.

### **3. Maastricht Treaty or Treaty on the European Union (TEU)**

Any discussion and in-depth analysis of the EMU and the Euro will be incomplete without a thorough knowledge of the Maastricht Treaty. In the Maastricht Treaty, the EC is referred to for the first time as the European Union (EU), a name denoting a higher level of integration. The Maastricht Treaty explicitly states that only countries, which have demonstrated monetary, fiscal, and exchange rate stability would be permitted to join the EMU and adopt the Euro. Such strict requirements were imposed to provide assurance that the EMU will be successful, and the Euro will be a strong international currency. Most of the requirements of the Maastricht Treaty were imposed by Germany which was determined not to compromise on price stability and accept a currency softer than the Deutsche Mark (DM).

The first Maastricht convergence criterion deals with the maximum allowed inflation rate. According to the inflation criterion, candidate countries must maintain low inflation to qualify for EMU membership. **“Each country’s inflation rate should not exceed 1.5 percent the average inflation rate of the three countries with the lowest inflation rates.”** There is unanimity among economists that inflation is the most important criterion, thus countries with high inflation rates do not qualify for EMU membership. The rationale for the importance of the inflation criterion is that if a high inflation country is allowed to join the EMU, it will create a major and insurmountable problem to the application of the common monetary policy. Inflation and interest rates after the introduction of the EMU for such a high inflation country will not converge to the common inflation and interest rate of the EMU countries.<sup>6</sup>

Table A in the Appendix shows the performance of all present 16 EA countries in reference to the Maastricht Inflation Criterion from 1996 through 2008. The top 11 countries are the first to join the EMU in 1999. The 12<sup>th</sup> country is Greece, which joined in 2001. According to Table A, all countries achieved price stability prior to joining the EMU. This demonstrates that EMU candidate countries responded to the Maastricht Inflation Criterion with contractionary monetary policies demonstrating their determination to join the EMU. According to data in Table A, the three EA countries which most often violated the Maastricht Inflation Criterion are Ireland, Spain, and Greece. These countries, however, attained high GDP growth during this period.

The second Maastricht criterion pertains to long-term interest rates as this is measured by the ten-year government bond yield. **“Each country’s long-term interest rate cannot exceed 2 percent the average long-term interest rate of the three countries with the lowest inflation rates.”** Since inflation is a major component of the long-term interest rate; the two criteria are closely related and reveal similar information. After the adoption of the Euro, interest rates in the EA countries were almost equal in all

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<sup>6</sup> The inflation criterion is so important that many authors support the view that once countries meet the inflation criterion all other Maastricht criteria become redundant.

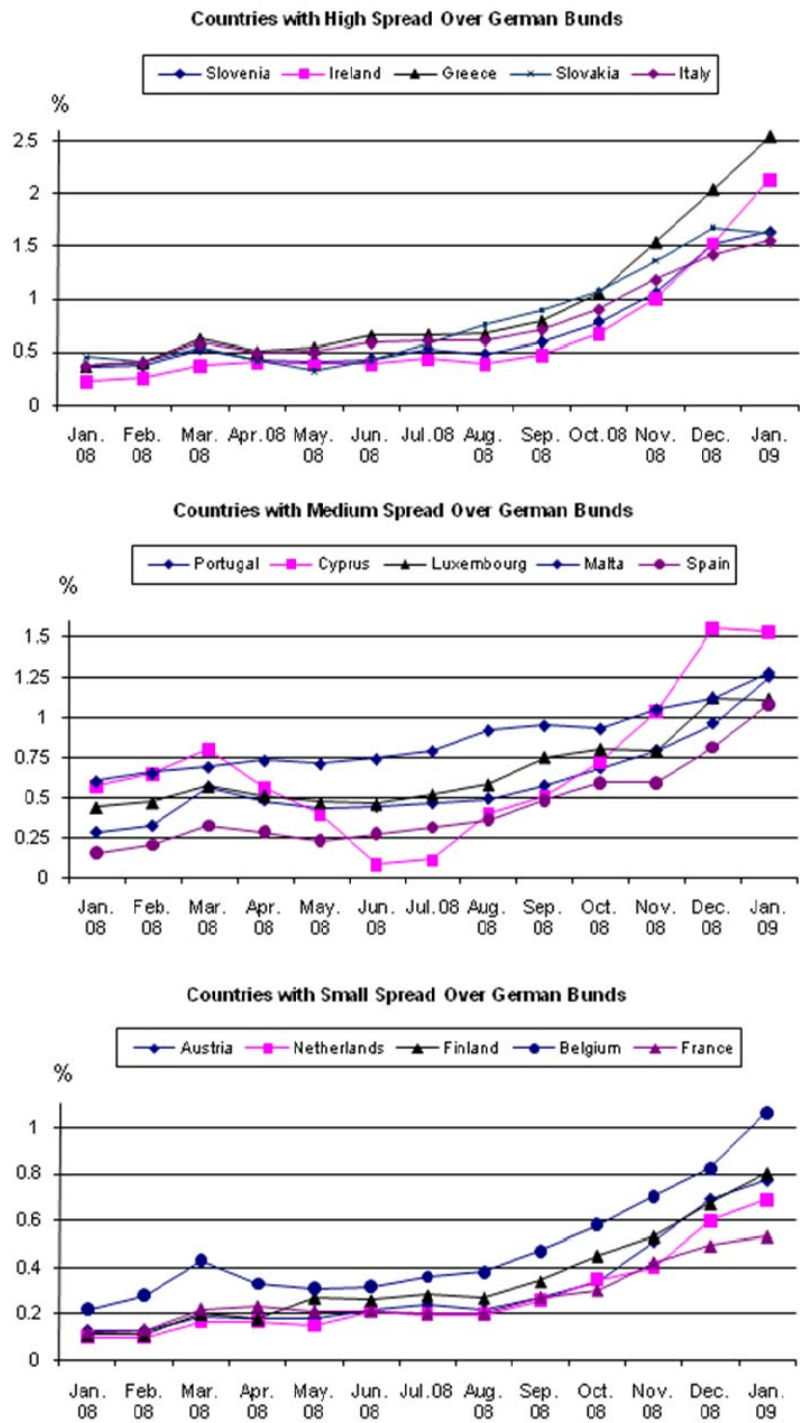
member countries. Most recently, starting in the fall of 2008, however, long-term interest rates of a small group of Eurozone countries exceeded the German long-term interest rate due to added default and liquidity risk premia to these countries' long-term government bond interest rates. This interest rate differential surfaced as credit rating agencies began downgrading the government bonds of Ireland, Greece, Spain, and Portugal.<sup>7</sup>

The long-term interest rate is related to inflation, or more precisely, to expected inflation. Because the performance of the EA countries in terms of long-term interest rate resembles the performance of inflation, we do not report these historical statistics. Instead, in Figure 1 we show data of the national, long-term interest rate differentials in relation to the German interest rate, measured with the 10-year government bond yields. The interest rate differentials (spreads) of the EA countries are presented in three groups of countries in relation to the German bonds as high, medium, and low spreads. The countries with the largest interest rate differentials, which caused more concern are Ireland and Greece, and to a lesser extent, Italy.

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<sup>7</sup> Such interest rate differentials, capturing a default and liquidity risk premia, delivered a signal to those EA countries which will likely find it difficult to refinance their sovereign debt, unless they adopt drastic measures to restore fiscal stability.

Figure 1



The third Maastricht convergence criterion states, “**The government deficit to GDP ratio cannot exceed 3 percent.**” EMU candidate countries are required to exercise fiscal discipline because fiscal

profligacy causes both high inflation and high interest rates. Large annual deficits also increase national debt, which constitutes the second fiscal Maastricht criterion.

Table B in the Appendix shows the performance of all present 16 EA countries in reference to the deficit Maastricht Criterion. It is evident from Table B that all countries made substantial progress in reducing public deficits in order to qualify for EMU membership. It is also clear from Table B that countries often exceeded the maximum three percent to GDP ratio Maastricht Criterion. Particularly during recessionary periods, EA countries found it very difficult to comply with this fiscal rule.

There was fear that once the EMU was established and countries secured membership, they would no longer have an incentive to pursue fiscal discipline. For this reason, upon the insistence of Germany, Euro Area countries adopted the Stability and Growth Pact (SGP) in June 1997 at the Amsterdam Summit of the European Council. According to SGP, EA countries were legally responsible to pursue fiscal stability. This was going to be achieved when EA countries attain medium-term budget positions of close to balance or in surplus. Such a requirement can be achieved when countries generate balanced budgets or surpluses during normal times and deficits to GDP ratios not exceeding 3 percent during recession times. Violation of the SGP entailed penalties to violating member countries. The penalties varied with the severity and duration of the violation. Furthermore, the SGP included the “No bailout clause,” which states that if an EMU country is unable to refinance its debt, it will not be bailed out by the ECB or by any of the other EA member countries.

Starting in 2001, the EA countries began violating the maximum allowed deficit to GDP criterion. The EU Commission, at first, tried to enforce the SGP. This turned out to be a difficult task. Small countries complied with the fiscal rules of the SGP. Larger countries, namely France, Italy, and Germany defied the SGP. On November 26, 2003, at the ECOFIN meeting, France and Germany persuaded the Economic and Finance Ministers to freeze the implementation of the SGP. The Commission took the ECOFIN’s violation to the European Court of Justice. The European Court of Justice found that France and Germany violated

the SGP, but the Court did not impose any penalties as it was requested by the EU Commission. The SGP was revised in 2005 in order to take into consideration the difficulties of the EMU countries in complying with the pact. The revised SGP became more flexible; it allows, for example, countries with low public debt below the 60 percent maximum allowed by the second fiscal Maastricht criterion to incur larger deficits than three percent allowed by the SGP. Countries under the revised SGP must address the issue of the EA's aging population, which will impose additional burdens on the fiscal position of the countries. EU member states were advised to respond with fiscal consolidation to prevent further deterioration of their future fiscal situation.

The fourth Maastricht convergence criterion states that “**The national public debt to GDP ratio should not exceed 60 percent.**” Large national debt to GDP ratio can be detrimental to an economy because it imposes a burden to the country in terms of large annual interest payments. Heavily indebted countries, in some rare cases, may find it very difficult, if not impossible, to service their national debt. This happens because credit markets often impose an additional burden through higher interest rates on their sovereign debt as this happened during the present financial crisis starting in the fall of 2008.

Table C in the Appendix shows the performance of all 16 EA countries in comparison to the 60 percent debt to GDP ratio Maastricht reference value. It turned out that the public debt Maastricht criterion was the most difficult one for candidate EMU countries to comply. Belgium, Italy, and Greece had accumulated a public debt to GDP ratio exceeding 100 percent. For this reason, the European Council decided to ignore this criterion and chose to move forward with the establishment of the EMU by bending the public debt criterion. A close look at Table C clearly indicates that the gray area which shows the years that countries violated the Public Debt criterion is equal or even exceeds the white area, which indicates years of compliance. Several countries still violate the public debt rule because it is difficult for countries to reduce public debt, especially during recessionary periods.

A few authors criticized the Maastricht convergence criteria for being arbitrary and irrelevant to OCA theory (Buiter et al, 1993). Several authors have shown that the countries' efforts to comply with the Maastricht rules prolonged the 1990-1993 recession as candidate countries were forced to apply contractionary monetary and fiscal policies (DeGrauwe, 2000).

The fifth and last Maastricht convergence criterion pertains to the exchange rate: **“Each EMU candidate country must maintain its exchange rate within the +/-2.25 percent band of the ERM without devaluing its currency in the last two years prior to the examination.”**<sup>8</sup> In order for countries to meet the exchange rate criterion, they must maintain price stability. Countries with higher inflation rates than other countries almost always experience pressure on their currency and cannot maintain their exchange rate within a certain range without devaluation.

For those countries that adopted the Euro, the exchange rate criterion is of course irrelevant. These countries are responsible to meet the requirements of the ERM, which after 1999 has been renamed ERM2. An interesting episode regarding the exchange rate Maastricht Criterion occurred during the Summer of 1993 when EMU countries were unable to maintain their currencies within the +/- 2.25 percent band. After several forced devaluations of EC countries' currencies, the European Council met on August 1, 1993 and decided to widen the ERM band from +/- 2.25 percent to +/- 15 percent. The decision of the European Council, which made the ERM band practically non-binding, demonstrated that the EMU project was a political commitment (Sadeh and Verdun, 2008).

In addition to the Maastricht convergence criteria, the Maastricht Treaty required candidate EMU countries to render complete independence to their central bank from the executive branch of the government. Such a requirement was extremely important because only independent central banks can pursue price stability without pressure from governments. Governments often have an incentive to pursue

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<sup>8</sup> Examination refers to the country's performance evaluation at a particular date in reference to the Maastricht convergence criteria prior to joining EA.

high current employment and GDP growth policies at the expense of higher future prices. Such a temptation is particularly more relevant during election years. There exists empirical evidence supporting the fact that independent central banks perform better in terms of price stability than central banks that are part of the executive branch of a government.<sup>9</sup>

The five Maastricht convergence criteria pertain to five nominal macroeconomic variables and have very little to do with the desired characteristics of candidate countries according to the OCA theory. Furthermore, the Maastricht convergence criteria do not require real convergence among countries.<sup>10</sup> Germany was the country with the most influence in imposing the Maastricht convergence criteria. After experiencing hyperinflations during World War I and II, and in between the two wars, Germany became the first country after the end of the WW II in Europe to render constitutional independence to its central bank, the Bundesbank. Since then, the Bundesbank has successfully pursued price stability. The European Central Bank (ECB) upon the insistence of Germany was located in Frankfurt, and was modeled after the Bundesbank. Consequently, the ECB was also assigned a single mandate of price stability, and has been given complete independence from national governments, and other EU institutions.

The path for the formation of the EMU was rather timely and involved as the EMU was established in three different stages. During the first stage, which began on July 1, 1990, three years before the Maastricht Treaty became effective, countries began removing capital controls according to the requirements of Single European Market program. They coordinated monetary and fiscal policies and maintained their currencies within the normal band of +/-2.25 percent. This first stage lasted till December 31, 1993.

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<sup>9</sup> See, for example, Alesina, A. and Summers, L., 1993.

<sup>10</sup> Real convergence is measured with the cross section standard deviation of the real per capita GDP of a group of countries or regions for a certain period. This is known as sigma ( $\sigma$ ) convergence. Another measure of real convergence is beta ( $\beta$ ) convergence. Beta convergence measures the annual rate at which countries catch up to steady state real per capita GDP according to the neo-classical growth model, see Barro & Sala & Martin (1992), Yin, Zestos, & Michelis (2003), and Zestos and Yin (2009).



In the second stage, which began on January 1, 1994, and lasted until December 31, 1998, candidate countries were evaluated according to an elaborate surveillance process based on separate economic reports prepared by the EU Commission and the European Monetary Institute (EMI) that were submitted to the Council. The reports were mainly in reference to the five Maastricht criteria and other requirements of the Maastricht Treaty.<sup>11</sup> During this period, the EMI was also established in Frankfurt, Germany with the task to prepare all the groundwork for the completion of the EMU. The TEU provided that, according to the reports of the EMI and the EU Commission, the European Council would decide by December 1996 if the EMU would be established. According to these convergence reports, if the majority of the candidate countries qualified for membership, the EMU would begin January 1997. If the EMU was not established in 1997, the EMU would be launched on January 1999 even if only two countries qualified for EMU membership. According to the convergence reports in 1996, the majority of the countries did not qualify for EMU membership.

The third stage began on January 1, 1999 when the EMU was launched and the Euro was introduced in the form of checking and savings accounts. This stage lasted until December 2001. On January 2002, the Euro was also introduced in the form of coins and banknotes. For the first two months of 2002, the Euro circulated along with the national currencies. On March 2002, the Euro replaced the national currencies of 12 EA countries.

#### **4. The Dollar-Euro Exchange Rate Determination According to Economic Fundamentals**

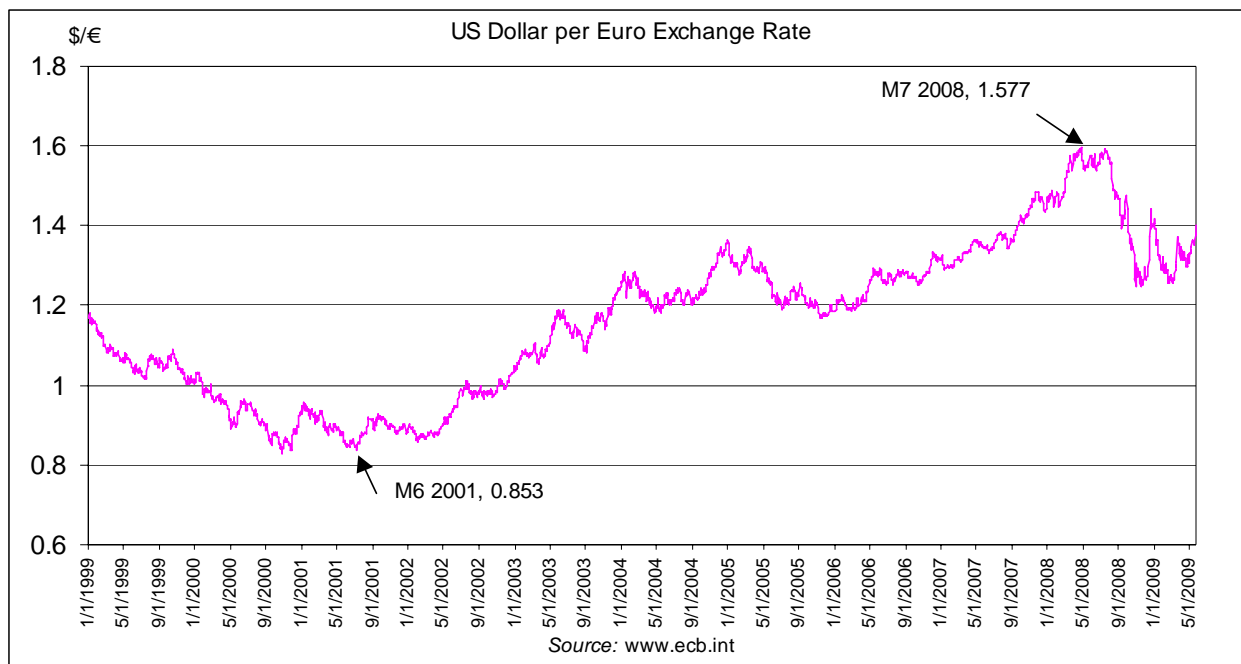
The Euro was introduced on January 1, 1999, equivalent to 1.17 dollars. This value was identical with the dollar per ECU exchange rate as the Euro replaced the ECU. The performance of the dollar-Euro exchange rate has been rather unstable. After its introduction on January 1, 1999, the Euro began a long path of depreciation till it reached its minimum value of .853 dollars in June 2001. After June 2001, the

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<sup>11</sup> Such reports are still prepared for the remaining candidate countries and the EMU members who are under derogation, i.e. under the watchful eye of the Commission for violation of the SGP rules.

Euro remained relatively stable till March 2002. Starting in March 2002, the Euro began a long course of appreciation up to the present with an exception of the fall of 2008 and the early part of 2009. During this period, the demand for dollars surged as a result of the subprime mortgage crisis. Investors sought refuge to the reserve currency, which was perceived as a safe haven. The depreciation of the Euro continued till April 2009 when the Euro returned to its upward trend and began appreciating again. The Euro attained the maximum value of 1.577 dollars in July 2008. There exists a consensus among economists and expert analysts that the Euro was undervalued in the later part of 2000 till March 2002, a time when the Euro started a prolonged appreciation path. The graph of the dollars per Euro exchange rate is presented below.

**Figure 2. The dollar-Euro historical exchange rates.**

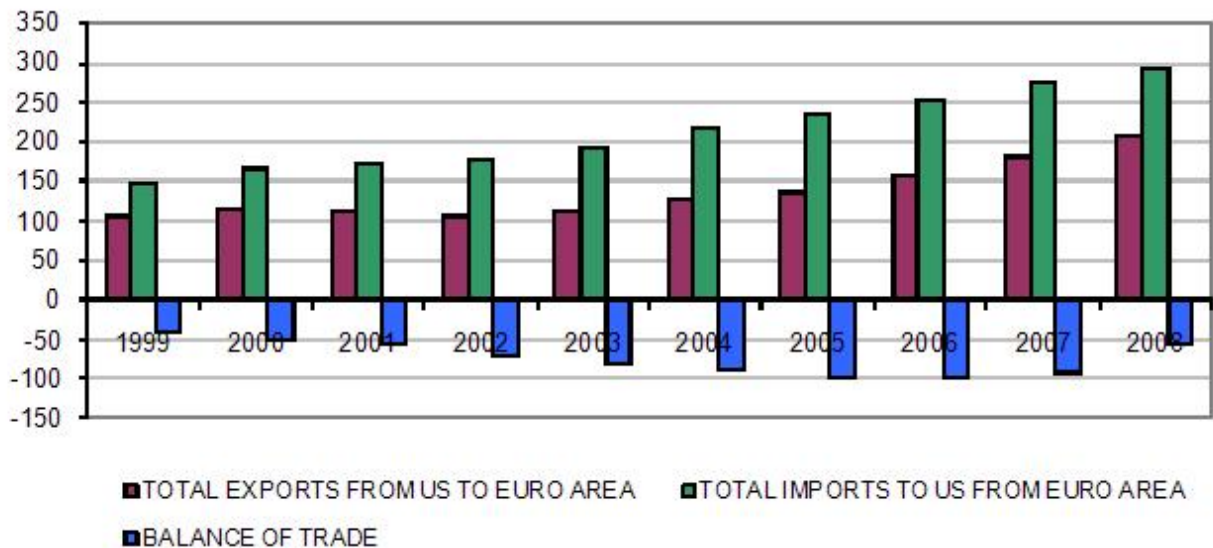


This section of the paper examines the most important factors that are most likely to have affected the Euro-dollar exchange rate. Such factors are usually called the fundamentals or economic fundamentals. Since the exchange rate is the price of one unit of foreign currency in terms of the number of domestic currency units, factors affecting exchange rates are also called market fundamentals. Therefore, we study

the behavior of the price of Euro in terms of dollars by employing a supply-demand for Euros diagram and by identifying those variables that influence the supply and demand for Euros.<sup>12</sup> Meese and Rogoff (1983), however, found that models based on economic fundamentals were not able to predict out of the sample systemic movements of major currencies' bilateral exchange rates better than random walk models. Rogoff (1999) reaffirmed the original finding. The unexpected results of the two authors motivated substantial research on the topic.

In a demand and supply of Euros diagram, the demand for Euros arises because of two main reasons. First, US residents and businesses demand goods and services from the Euro Area countries. Second, due to the fact that US residents and firms demand Euros to invest in the Euro Area in the form of Foreign Direct Investments (FDI) or in the form of Portfolio Investments (PI). FDI pertains mainly to construction of new plants in the EA countries, or to transfer of ownership of existing plants. PI refer to financial investment in stocks and bonds in the EA countries. Similarly, EA residents and firms supply Euros to buy US goods and services, or to invest in the US in the form of FDI and/or in the form of PI.

**Figure 3**  
 Billions of US\$  
 Annual US vs Euro Area Exports, Imports, and Balance of Trade



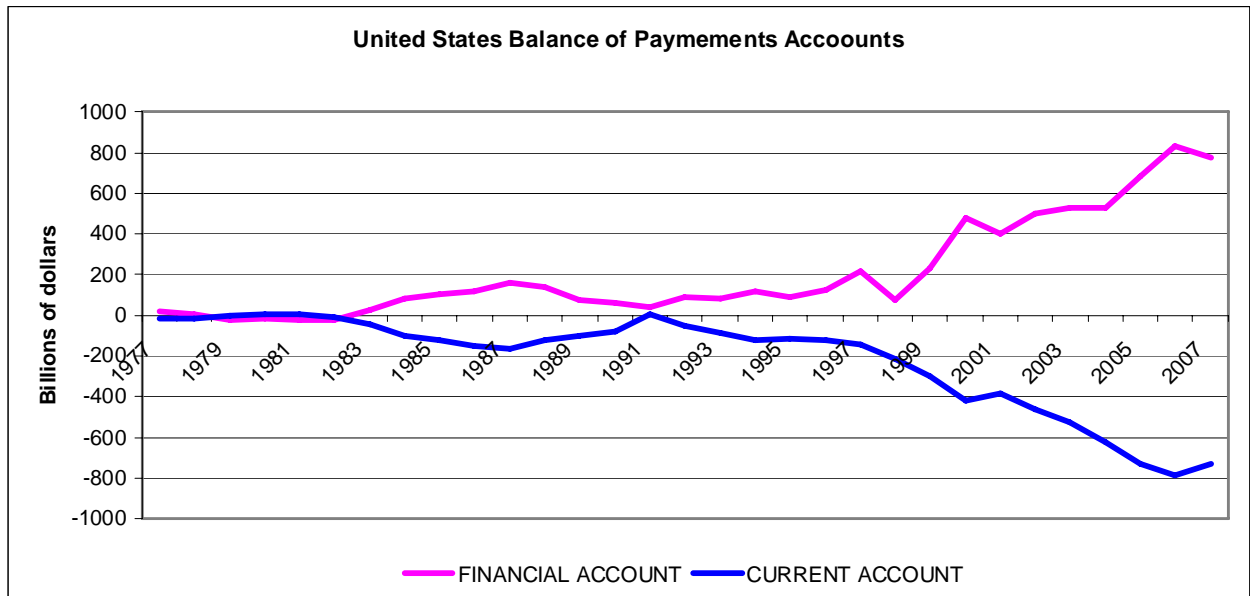
Source: Directions of Trade, IMF Economic Database

<sup>12</sup> The analysis will produce identical results if the focus was on the supply and demand for dollars. In this market, the exchange rate will be the number of Euros per one dollar, i.e. the inverse of the dollars per one Euro exchange rate.

According to Figure 3, the US, since the establishment of the EMU and the introduction of the Euro, has always experienced a trade deficit with the Euro Area countries. This negative trade balance, however, had been increasing up to 2005. In 2006, it leveled off and began shrinking in 2007 and 2008. If the only factor affecting the exchange rate was the trade balance, then this would have resulted in a net capital outflow from the United States. This would have caused an appreciation of the Euro till 2006 and depreciation after 2006. The US deficit with the EA countries, however, is relatively small in comparison to the total deficit of the US in relation to the rest of the world.<sup>13</sup>

Starting in the late nineties, the US experienced an increasing current account (CA) deficit. This is shown in Figure 4 below where the CA is depicted in the same graph along with the financial account (FA). The CA captures the total outflow (inflow) in addition to trade balance for goods and services and includes the net income capital flows and unilateral transfers.

**Figure 4**



<sup>13</sup> Economists, however, estimate that only about one fifth of the total capital flows among countries take place for the purpose of financing trade.

Large capital inflows to the US are necessary to finance the CA deficits. This is depicted by an almost symmetrical FA (financial account) surplus. The large and negative CA of the US is financed with increased indebtedness of the US to the foreign countries, which generate CA surpluses with the US. The countries with the CA surpluses invest their dollar earnings from exports back into the US in stocks and bonds. As long as foreign exporting countries continue investing their export proceeds in the US, a large US CA deficit can be sustained. There is, however, evidence that trade surplus countries with the US have already begun diversifying some of their dollar earnings by investing in currencies other than dollars. There is empirical evidence that some countries began gradually substituting Euros for dollars. The decision of these countries is considered rational because diversification provides some protection for these countries against the continuous depreciation of the dollar.

Feldstein (2008) noted that the composition of capital inflows to the US has been shifting. Private investments in stocks and corporate bonds that were attracted to the US as a result of the higher productivity and competitiveness of the US economy are gradually diminishing. Instead, central banks and governments, Feldstein claims, have increased purchases of the US government securities. In addition, it is a well-known fact that a few Asian countries have accumulated dollar reserves and US securities to keep their currencies undervalued with respect to dollar. They pursued this strategy to remain competitive in their export sectors and maintain large surpluses in their trade balance with the US. Although data on capital inflows to the US do not support this shift in capital inflow composition, Feldstein (2008) claims that this is possible as foreign central banks and governments hire private companies to carry out their transactions, thus US government inflows appear as private. Recently, several countries are becoming increasingly more careful how they invest their export earnings. A few countries have created foreign wealth funds in order to make more prudent decisions on their official investments abroad (Cooper, 2008). Furthermore, Feldstein states that the US deficit will eventually be reduced, but only gradually, as it does not make sense for foreign countries to continuously extend gifts to the US instead of investing their export earnings to their own countries. CA surplus countries holding US assets and dollar reserves have been diversifying their

currency reserves and securities holdings. It is not, nonetheless, in these countries' interest to drastically drop their dollar holdings as this will lead to a crash in the US dollar foreign exchange market. Such an action will hurt first the exporting countries as the value of their dollar portfolios will be substantially reduced. Furthermore, it will cause significant instability in the US economy and a major international exchange rate crisis.

The large CA deficit of the US is considered to be a major source of international imbalances and a possible cause of future international economic instability. Such trade imbalances are becoming harder to cope with as they affect the value of the dollar, currently the most important currency employed by many countries for reserves, trade, and many financial transactions. For this reason, in order to understand the development of the dollar exchange rate versus other currencies and particularly the Euro, it is important to study the structure of the US economy. For over a decade, economists pointed out that a widening US trade deficit may not be only the result of deteriorating US international competitiveness, but also the outcome of domestic US macro imbalances between total national saving and total investment. An explanation, as to how US domestic imbalances between total domestic saving and investment can lead to large CA deficits in the US, is offered below.

Assume that the US is a closed economy and the equilibrium output,  $Y$ , is equal to aggregate demand, which consists of the sum of consumption ( $C$ ), investment ( $I$ ) and government expenditures ( $G$ ),

$$(1) \quad Y = C + I + G$$

A trade deficit arises because of a deficit in the private sector, when  $S < I$  or because of a deficit in the public sector when  $T < G$ .<sup>14</sup> It is also possible for a country to occur a trade deficit when both the private and public accounts are both in deficit or the deficit in one of the two accounts exceeds the surplus in the other.

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<sup>14</sup>Where  $S$  is private saving,  $I$  is private investment,  $G$  is government expenditure, and  $T$  is Taxes.

If  $Y > C + I + G$ , then this relation indicates that the US has generated additional output from what is domestically demanded. This additional output can be lent to foreign countries. If, however,  $Y < C + I + G$ , then the US will have to borrow from abroad since its total domestic demand exceeds national production. In the first case, the US generates positive saving, which it lends abroad, in the second case, the US dissaves and is forced to borrow from abroad. By employing the standard Keynesian macroeconomic equilibrium condition for the US economy, below, the US deficit can be attributed to either low saving in relation to investment or to low taxes in relation to government expenditures.<sup>15</sup>

$$(2) \quad (S - I) + (T - G) = X - M$$

This equation also suggests that the necessary adjustments of the US macroeconomic imbalances are difficult. For the US to reduce the large trade deficit, it must increase saving and/or reduce private investment. It is difficult for the government to successfully induce people to save. No one can imagine a government adopting policies reducing investment as this will lead the economy into a recession. Politicians avoid raising taxes or reducing government expenditures, especially during election years.

Other than financing trade, capital flows also occur for the purpose of Portfolio investment (PI) and Foreign Direct Investment (FDI). The main variable affecting PI and FDI is the real rate of return. Capital flows to finance PI depend mostly on the interest rate differential of similar securities of two countries of the same maturity.<sup>16</sup> Therefore, the US and EA real interest rates are critical for this analysis. All interest rates are affected by monetary policies. Central banks conduct monetary policy generally by controlling a key interest rate known as operating instrument. The Fed's operating instrument is the federal funds rate

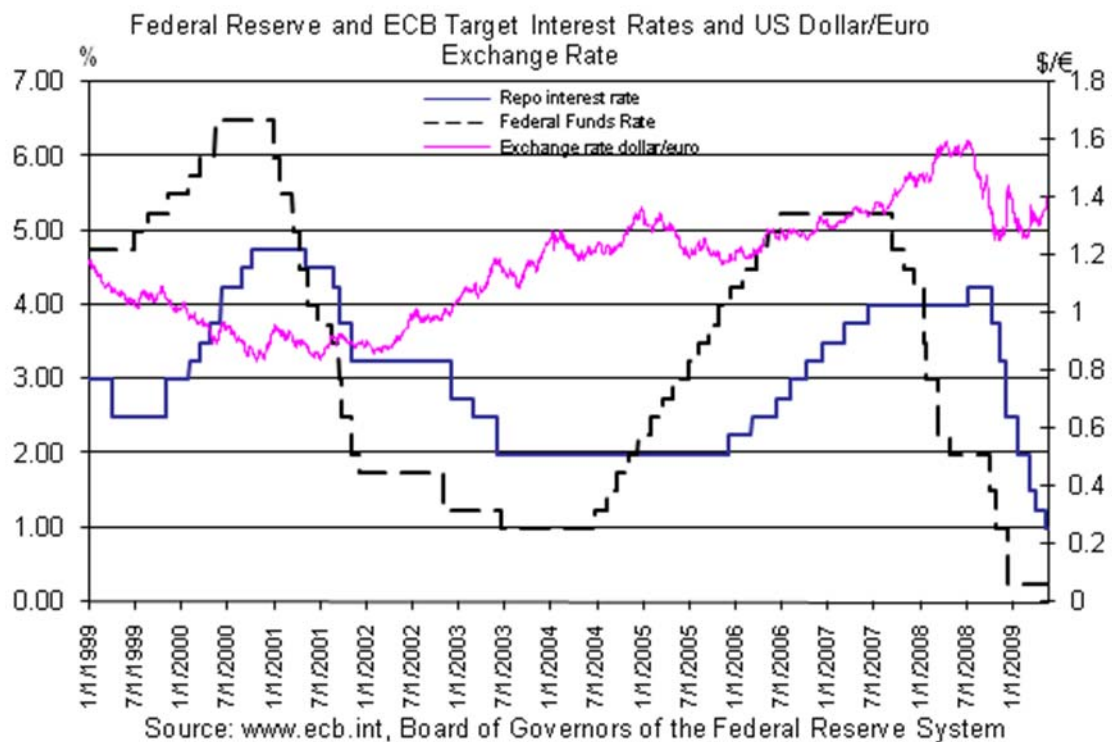
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<sup>15</sup> This equation is another form by the macroeconomic equilibrium condition  $S + T + M = I + G + X$ , known also as leakages=injections.

<sup>16</sup> Real interest rate is equal to the nominal interest rate minus the expected rate of inflation,  $r = i - \pi^e$ , this relation is known as Fisher's equation.

$r_{ff}$ .<sup>17</sup> The European Central Bank employs the repo rate, which is the interest rate that the ECB charges financial institutions when it provides liquidity through the open market refinancing operations. As a first approximation to find a relation between economic fundamentals and the Euro exchange rate, we study the relation of the two monetary variables the  $r_{ff}$  and the repo, which are shown together in the graph along with the nominal dollar-Euro exchange rate on Figure 5.

**Figure 5**



According to Figure 5, it is evident that during the first two and a half years, the  $r_{ff}$  was above the repo. During this period, the Euro was depreciating in relation to the dollar. Once the  $r_{ff}$  was equal to the repo rate, the dollar-Euro exchange rate leveled off for about a year. A Euro appreciation followed a few months after the repo rate exceeded  $r_{ff}$ . Up to this point, market fundamentals worked in a predictable way regarding the behavior of the Euro exchange rate. When US and EA target interest rates switched in terms

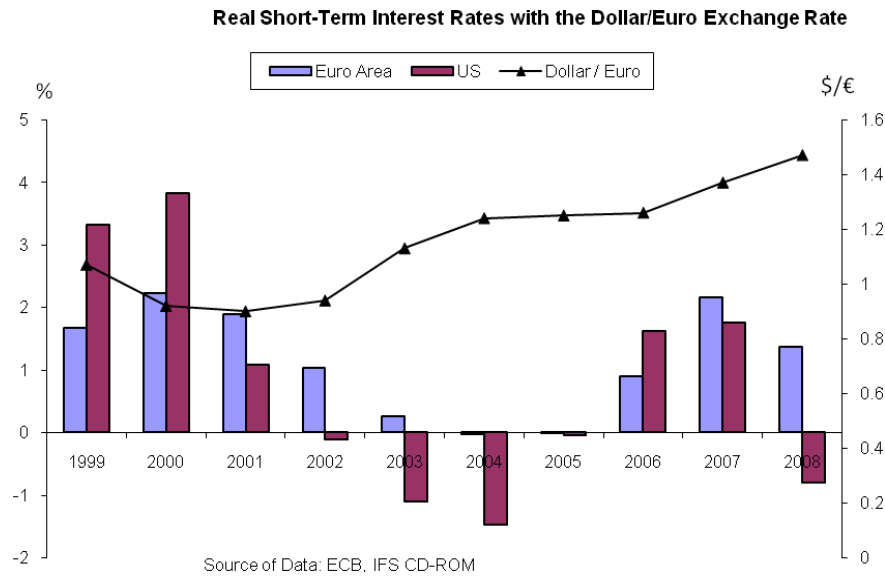
<sup>17</sup> This is the rate at which Federal Reserve banks borrow from each other overnight to meet the reserve requirements. Thus  $r_{ff}$  is the price of borrowed reserves.



of magnitude, then the trend of the exchange rate reversed as well from depreciation to appreciation. After 2007, the relation between the key interest rate differential and the Euro exchange rate cannot be explained since the  $r_{ff}$  was below the repo, but the Euro kept appreciating. The exception to the Euro appreciation trend was the period of the subprime mortgage crisis starting in the fall of 2008.

A more relevant variable to explain and predict the Euro exchange rate is the real interest rate, which is much more closely related to the real rate of return.<sup>18</sup> Figure 6, below, shows US and EA annual real short-term interest rates measured on the left-hand side axis along with the nominal dollar-Euro exchange rate measured by the right-hand side axis.

**Figure 6**



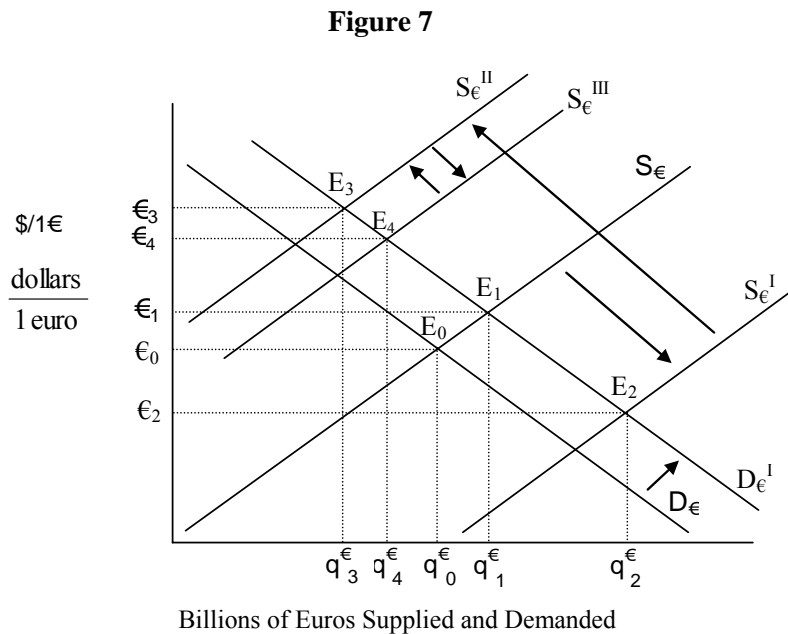
The three-month US real Treasury bill rate and the three month real interbank rate of the EA are compared in the bar chart of Figure 6, above. Figure 6 portrays well the relation among the three variables. The first two years after its introduction, the Euro depreciated because the US real short-term interest rate was higher than the EA real short-term interest rate. In 2001, a switch occurs and the real EA interest rates

<sup>18</sup> The real rate of return between a domestic versus a foreign investment must also take into consideration the expected appreciation (depreciation) of the foreign currency (Zestos, 2006).

exceed the real US interest rate. This is the year when the dollar-Euro exchange rate reversed trend and the Euro began a long appreciation path. The Euro kept appreciating because the US experienced lower real interest rates in relation to the EA. The US even recorded negative real interest rates in four years. One drawback of this analysis is that the graph does not show the depreciation of the Euro caused by the financial crisis during the fall of 2008. This, however, is a result of aggregation since we employ annual data.

**5. Exchange Rate Determination: A Diagrammatic Approach**

Figure 7, below, depicts the dollar-Euro exchange rate market as it evolved in the last ten and a half years. The diagram captures the most important events that influenced the dollar-Euro exchange rate. The initial value of the Euro in terms of dollars is shown in the graph to be  $\epsilon_0$ . This value is found at the intersection of the demand and supply lines for Euros,  $D_\epsilon$  and  $S_\epsilon$ , respectively, corresponding to equilibrium  $E_0$ , which resulted in  $q_0^\epsilon$  amount of Euros traded. US residents and firms demand Euros to pay for purchases of imports from the EA and to invest in the EA countries. Similarly, EA residents and firms supply Euros in exchange for dollars to buy US goods and services and invest in the US.



During the 1991-2001, decade the US economy expanded at a phenomenal rate of growth. The unprecedented US rate of growth was attributed to the information technology (IT) boom that boosted the US to take a lead in international competitiveness. Income increases in the US during 1999-2001 caused an increase in the demand for Euros to finance imports from Euro Area countries. Such an increase in demand for Euros caused an appreciation of the Euro from  $\epsilon_0$  to  $\epsilon_1$  found at the intersection of the new demand for Euros  $D_e^1$  with the initial supply of Euros  $S_e$  at the equilibrium  $E_1$ . The number of Euros traded has increased to  $q^{\epsilon}_1$ . During this decade, which constitutes the longest expansion in its history, the US attained both high increases in labor productivity and increases to the rate of return in investment. The US expansion was also accompanied by higher interest rates than those in the EA, thus the US attracted capital inflows from the EA. In Figure 7, this is shown with a large increase in the supply of Euros as European investors were offering their Euros in exchange for dollars in order to pursue profitable investment opportunities in the US. The disproportionately larger increase in supply than the demand for Euros led to a reduction in the equilibrium exchange rate to  $\epsilon_2$  from  $\epsilon_1$  below its initial value  $\epsilon_0$  and an increase of the quantity of Euros traded equal to  $q^{\epsilon}_2$ . The large capital inflows to the US resulted in a prolonged depreciation of over two years for the Euro versus the dollar.

The year 2001 became a turning point for the US, reversing a ten year growth of the US economy. Three events were the cause of the 2001-2003 recession that also have led to a reduction of interest rates.<sup>19</sup> Lower US interest rates along with uncertainty about the US economy induced a reduction in the supply of Euros as European companies and citizens had no longer an -incentive to invest in the US. Such a reduction in the supply of Euros led to a prolonged appreciation of the Euro. In Figure 7, this is shown with

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<sup>19</sup> The three major events (shocks) played critical role for the disruption of the US growth era. The first shock began in July 2000 with the crash of the NASDAQ stock exchange, which lists the stocks of most IT firms. The second negative shock in the US was the corporate scandals because established corporations such as Enron, WorldCom, and Arthur Andersen were involved in embezzlement scandals. Lastly the worst negative shock on the US economy was the September 11, 2001 terrorist attack on the Pentagon and the New York Twin Towers. The national tragedy of September 11 substantially and irrevocably affected the US and the world economy.

a drastic decrease in supply of Euros from  $S^I_e$  to  $S^{II}_e$ , which together with  $D^I_e$  determined a new equilibrium at  $E_3$  resulting in an appreciation of the Euro exchange rate equal to  $\epsilon_3$ .<sup>20</sup>

The most recent shock of the dollar-Euro exchange rate occurred in the fall of 2008 as a result of the subprime mortgage crisis. The subprime mortgage crisis has induced an increase in the demand for dollars as investors sought a refuge to the dollar, which was considered a safe haven being the most important international reserve currency. In terms of Figure 7, this means that as the subprime mortgage crisis emerged, the supply of Euros shifted from  $S^{II}_e$  to  $S^{III}_e$ . This led to the depreciation of the Euro as the dollar-Euro exchange rate settled at  $\epsilon_4$ , corresponding to the market equilibrium  $E_4$ , where  $q^e_4$  Euros were traded. The situation, however, has reversed and by May 2009, the Euro found itself in a long-run trend of appreciation. The new equilibrium settled back at  $E_3$  and the dollar-Euro exchange rate at  $\epsilon_3$ .

## 6. The International Role of the Euro

The euro is the official currency of sixteen European countries, used for domestic transactions in the EA. The EA is a group of economically developed democratic countries with a population of 328 million people, much larger than the US. The US is, however, wealthier by 3 trillion Euros; its GDP for 2008 was 12.5 trillion Euros compared to 9.2 trillion Euros of the EA. The Euro is highly likely to become the official currency of the remaining EU countries, which did not adopt the single European currency yet.<sup>21</sup> The Euro was also unilaterally adopted by two small western Balkan countries, Montenegro and Kosovo. Such a unilateral decision by a country to adopt the single European currency is known as euroization. Although the EA cannot stop such a unilateral action, it does not encourage it since the EMU requires

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<sup>20</sup> The reduction in the US income during the recession triggered a reduction in the US imports from the EA. A decrease in the demand for US imports from the EA implied that the demand for Euros also decreased, and to a certain extent, dampened the appreciation of the Euro. Consequently, the dollar-Euro exchange rate ended up somewhere between  $\epsilon_1$  and  $\epsilon_3$ . This equilibrium is not shown to avoid crowding the graph.

<sup>21</sup> The exception is the UK and Denmark, which opted out from joining the EMU. All new EU members, according to the Maastricht Treaty, have to join the EA and adopt the Euro.

candidate countries follow an elaborate procedure prior to adopting the Euro. Specifically, candidate EMU countries must meet the Maastricht convergence criteria. Considering the time of the introduction of the Euro, a period during which the most important international currency, the US dollar, had already started facing difficulties, it is plausible that the Euro received a rather warm acceptance. The Euro increasingly became the currency of choice by non-EA international residents, businesses, governments, central banks, and international organizations for a variety of transactions. It is used to facilitate payments for international trade, investment, international bank loans, and deposits. The Euro is widely used in the issuance of debt securities and is used for international reserves.

Several central banks chose to diversify their foreign reserve holding by replacing dollars with Euros to better protect the value of their foreign reserve holdings in light of the continuous depreciation of the dollar. A few economists have gone so far as to suggest that the Euro has challenged the hegemony of the dollar as the world's most predominant currency (Heng Chen et al, 2005). It was suggested by these authors that the euro can be the source of international, financial, and exchange rate stability as the unilateral system centered around the dollar is potentially unstable. Many economists support the view that the large CA deficits of the US are unsustainable. There is, however, disagreement as to how the adjustment will take place, whether it will be a gradual one or abrupt. An abrupt depreciation will threaten the dollar's hegemony as there will be a rush to quick and substantial diversification in the portfolios of many investors.

On the other extreme, there are those who predicted that the Euro will not prevail, Feldstein (1997). More than ten years have passed since the introduction of the euro. As of today, it can be claimed that the Euro is the second most important world's currency. The Bank for International Settlements reported that Euro was used for about 37 percent of all foreign exchange transactions.<sup>22</sup> Figure 8, below, shows the total

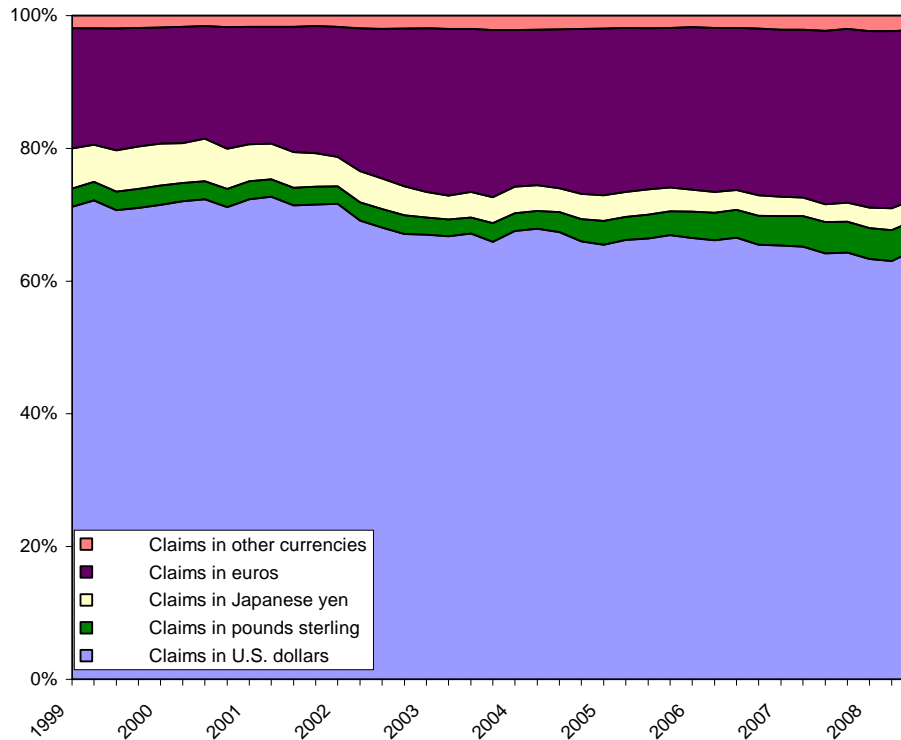
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<sup>22</sup> See Papaionnou and Porter (2008).

foreign reserves by currency. According to Figure 8, the Euro's share increased steadily from 18 percent in 1999 to 26 percent in 2008.

**Figure 8**

**Foreign Reserves by Currency**



## **8. The Future of the Euro and Concluding Comments**

The future of the Euro depends mainly on the health and vigor of the 16 EA member countries' economies. The EA countries' economies are diverse. They are, however, considered generally as efficient and competitive economies. They are endowed with well trained labor forces, but aging populations. They are free market economies and because of the many EU programs; they are increasingly becoming economically and financially integrated.

The future of the Euro depends also on the soundness and effectiveness of monetary and fiscal policies in the EA. Many economists had expressed doubts that a common monetary policy that sets one

interest rate for the entire EA will serve all the countries well. This skepticism was attributed to the fact that business cycles were not synchronized in all EA countries, thus the “one suit fits them all” policy was inappropriate according to the critics. This, however, has been changing due to common EU policies. Despite this criticism, the ECB has established a reputation as the most independent bank in the world, and it has an excellent record of maintaining low inflation but often at the expense of high unemployment. Fiscal Policy, nonetheless, is a much more complicated and problematic issue for the EA and the EU. The EMU countries share a common monetary policy, but they do not have a joint fiscal policy. Fiscal policies are conducted by the national governments. Lack of a common fiscal policy is, according to many authors, a big disadvantage of the EA.<sup>23</sup>

All the EMU countries must abide with the SGP. The latter created so much uncertainty as its validity and credibility were both challenged. The EU budget is small, only about 1 percent of the EU GDP, close to 130 billion Euros for 2009. Most EU budget expenditures are for income redistribution. The EU countries, therefore, do not share a fiscal stabilization policy. A few European leaders pointed out recently that the EU does not need a discretionary fiscal policy as automatic fiscal stabilizers of the European welfare states are very strong. The subprime mortgage crisis, however, made it evident that the EU needs a coordinated joint fiscal response to cope with the crisis. Several measures were taken to fight the crisis, most at the national level, but very few at the EU level. The reason that the EU and the EA were unable to respond to the crisis is due to the substantial lack of own resources. The current financial crisis will serve well the EU countries if it sparks a long debate for the costs/benefits of a more centralized fiscal policy. Several economists who examined this issue are convinced that stabilization policy has the characteristics of a public good. As a result, it should be left to the highest level; i.e., the central authority of the EMU or the EU. Presently, this will most likely be the EU Commission.

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<sup>23</sup> See for example, Pullien and Schwarzer, and several cited references in this article.

The decision for the EA to raise new resources is a political and highly sensitive issue. Once European leaders are convinced that it is absolutely necessary that stabilization policy should be more centralized, it will happen as so many other programs promoting integration were adopted and successfully implemented. The decision to adopt a fiscal policy at the EA or, even better, at the EU level will be a major turning point; it will promote stability and unification in Europe. It is possible for the EU to increase the Value Added Tax or to introduce other taxes such as a European corporate or personal income tax. The alternative for some EA countries to drop the Euro and return to their national currencies will be messy and more costly as several EU officials and country leaders already have publicly expressed.

An additional source of revenue for the EA and the EU could be an issue of debt, i.e. Euro-bonds, in addition to national bonds. The increase in resources will allow the central EMU authority to jointly help EA and EU countries, which are in financial distress. Euro-bonds would also make it easier for the ECB to more effectively apply the common monetary policy by using Eurobonds in its open market operations to influence liquidity and interest rates in the EA.

Despite its shortcomings, the vast majority of experts, politicians, economists, and many others believe that the Euro made a remarkable and impressive ten year journey. The currency was eagerly accepted, not only by the EA countries for domestic and international transactions but also by non-EA countries, businesses, central banks, and foreign government for a variety of transactions including reserves. In the next 10 years, we should expect to see a bilateral international monetary and exchange rate system with the dollar and the euro side by side, but possibly joined by the currencies of some important emerging economies playing a secondary role to the dollar and euro in the world economy.



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## APPENDIX

Table A

Historical Inflation Rates of the EU 16 Member States According to Two Maastricht Convergence Criterion												
	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Austria</b>	1.8	1.2	0.5	2.0	2.3	1.7	1.3	2.0	2.1	1.7	2.2	3.2
<b>Belgium</b>	1.8	1.5	1.1	2.7	2.4	1.6	1.5	1.9	2.5	2.3	1.8	4.5
<b>Finland</b>	1.1	1.2	1.3	3.0	2.7	2.0	1.3	0.1	0.8	1.3	1.6	3.9
<b>France</b>	2.1	1.3	0.6	1.8	1.8	1.9	2.2	2.3	1.9	1.9	1.6	3.2
<b>Germany</b>	1.2	1.5	0.7	1.4	1.8	1.4	1.0	1.8	1.9	1.8	2.3	2.8
<b>Ireland</b>	2.2	1.2	2.6	5.2	3.9	4.8	4.0	2.3	2.1	2.7	2.8	3.1
<b>Italy</b>	4.0	1.9	1.6	2.5	2.4	2.6	2.8	2.2	2.2	2.2	2.1	3.5
<b>Luxembourg</b>	1.2	1.4	1.0	3.8	2.4	2.1	2.5	3.2	3.8	3.0	2.7	4.1
<b>Netherlands</b>	1.4	1.9	2.0	2.3	5.1	3.9	2.2	1.4	1.5	1.7	1.6	2.2
<b>Portugal</b>	n/a	1.9	2.2	2.8	4.4	3.7	3.3	2.5	2.1	3.0	2.4	2.7
<b>Spain</b>	3.6	1.9	2.2	3.5	2.8	3.6	3.1	3.1	3.4	3.6	2.8	4.1
<b>Greece</b>	7.9	5.4	2.1	2.9	3.7	3.9	3.4	3.0	3.5	3.3	3.0	4.2
<b>Slovenia</b>	n/a	8.3	6.1	8.9	8.6	7.5	5.7	3.7	2.5	2.5	3.8	5.5
<b>Cyprus</b>	n/a	3.3	1.1	4.9	2.0	2.8	4.0	1.9	2.0	2.3	2.2	4.4
<b>Malta</b>	n/a	3.9	2.3	3.0	2.5	2.6	1.9	2.7	2.5	2.6	0.7	4.7
<b>Slovakia</b>	n/a	6.0	10.5	12.2	7.2	3.5	8.4	7.5	2.8	4.3	1.9	3.9
<b>Maastricht Reference Value</b>	<b>2.6</b>	<b>2.7</b>	<b>2.1</b>	<b>3.2</b>	<b>3.5</b>	<b>3</b>	<b>2.7</b>	<b>2.6</b>	<b>2.9</b>	<b>3.1</b>	<b>3.1</b>	<b>4.1</b>

Cells boundaries indicate year when each one of EA16 countries joined the EA.

Data for the year 1997 are provided for reference purposes since the initial assessment was performed in 1997 before the introduction of the Euro. Cells shaded in grey indicate years when EA countries did not comply with the Maastricht inflation criterion.

Table B

Historical Deficit as Percentage of GDP of the EU 16 Member States												
	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Austria</b>	-4.0	-1.8	-2.3	-1.7	0.0	-0.7	-1.4	-4.4	-1.6	-1.6	-0.5	-0.4
<b>Belgium</b>	-3.9	-2.2	-0.6	0.0	0.5	0.0	-0.1	-0.3	-2.7	0.3	-0.2	-1.2
<b>Finland</b>	-3.5	-1.3	1.6	6.9	5.0	4.1	2.6	2.4	2.8	4.0	5.2	4.2
<b>France</b>	-4.0	-3.3	-1.8	-1.5	-1.5	-3.1	-4.1	-3.6	-2.9	-2.3	-2.7	-3.4
<b>Germany</b>	-3.3	-2.6	-1.5	1.3	-2.8	-3.7	-4.0	-3.8	-3.3	-1.5	-0.2	-0.1
<b>Ireland</b>	-0.1	1.1	2.7	4.8	0.9	-0.4	0.4	1.4	1.7	3.0	0.2	-7.1
<b>Italy</b>	-7.0	-2.7	-1.7	-0.8	-3.1	-2.9	-3.5	-3.5	-4.3	-3.3	-1.5	-2.7
<b>Luxembourg</b>	1.2	3.7	3.4	6.0	6.1	2.1	0.5	-1.1	0.0	1.4	3.6	2.6
<b>Netherlands</b>	-1.9	-1.2	0.4	2.0	-0.2	-2.1	-3.1	-1.7	-0.3	0.6	0.3	1.0
<b>Portugal</b>	-4.5	-3.5	-2.8	-2.9	-4.3	-2.8	-2.9	-3.4	-6.1	-3.9	-2.6	-2.6
<b>Spain</b>	-4.8	-3.4	-1.4	-1.0	-0.6	-0.5	-0.2	-0.3	1.0	2.0	2.2	-3.8
<b>Greece</b>	-6.8	-6.0	-3.1	-3.7	-4.5	-4.8	-5.7	-7.5	-5.1	-2.8	-3.6	-5.0
<b>Slovenia</b>	-1.1	-2.4	-2.0	-3.8	-4.1	-2.5	-2.7	-2.2	-1.4	-1.3	0.5	-0.9
<b>Cyprus</b>	n/a	n/a	-4.3	-2.3	-2.2	-4.4	-6.5	-4.1	-2.4	-1.2	3.4	0.9
<b>Malta</b>	-8.0	-7.7	-7.7	-6.2	-6.4	-5.5	-9.8	-4.7	-2.9	-2.6	-2.2	-4.7
<b>Slovakia</b>	-9.9	-6.3	-7.4	-12.3	-6.5	-8.2	-2.8	-2.4	-2.8	-3.5	-1.9	-2.2
<b>Maastricht Reference Value</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>	<b>-3</b>

Cells boundaries indicate the year when each one of EA16 countries joined the EA.

Data for the year 1997 are provided for reference purposes since the initial assessment was performed in 1997 before the introduction of Euro.

Cells shaded in grey indicate years when the EA countries did not comply with the public deficit Maastricht convergence criterion.

Table C

Public Debt as Percentage of GDP of the EU 16 Member States												
	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Austria</b>	68.3	64.4	67.2	66.4	67.0	66.4	65.4	64.8	63.7	62.0	59.4	62.5
<b>Belgium</b>	127.0	122.3	113.6	107.8	106.5	103.4	98.6	94.3	92.2	87.9	84.0	89.6
<b>Finland</b>	56.9	53.8	45.5	43.8	42.3	41.3	44.4	44.2	41.4	39.2	35.1	33.4
<b>France</b>	58.0	59.3	58.8	57.3	56.9	58.8	62.9	64.9	66.4	63.7	63.8	68.0
<b>Germany</b>	58.4	59.7	60.9	59.7	58.8	60.3	63.8	65.6	67.8	67.6	65.1	65.9
<b>Ireland</b>	72.5	63.7	48.1	37.7	35.5	32.2	31.1	29.4	27.5	24.9	25.0	43.2
<b>Italy</b>	120.9	118.1	113.7	109.2	108.8	105.7	104.4	103.8	105.8	106.5	103.5	105.8
<b>Luxembourg</b>	7.8	7.7	6.7	6.4	6.5	6.5	6.2	6.3	6.1	6.7	6.9	14.7
<b>Netherlands</b>	74.1	68.2	61.1	53.8	50.7	50.5	52.0	52.4	51.8	47.4	45.6	58.2
<b>Portugal</b>	59.9	56.1	51.4	50.4	52.9	55.5	56.9	58.3	63.6	64.7	63.5	66.4
<b>Spain</b>	66.8	65.3	61.5	59.2	55.5	52.5	48.7	46.2	43.0	39.6	36.2	39.5
<b>Greece</b>	101.6	104.1	102.5	101.8	102.9	101.5	97.8	98.6	98.8	95.9	94.8	97.6
<b>Slovenia</b>	20.4	20.8	23.9	26.8	27.4	28.1	27.5	27.2	27.0	26.7	23.4	22.8
<b>Cyprus</b>	50.2	54.4	58.7	58.8	60.7	64.6	68.9	70.2	69.1	64.6	59.4	49.1
<b>Malta</b>	39.0	47.5	57.0	55.9	62.1	60.1	69.3	72.2	69.8	63.7	62.1	64.1
<b>Slovakia</b>	31.1	33.8	47.8	50.3	48.9	43.4	42.4	41.4	34.2	30.4	29.4	27.6
<b>Maastricht Reference Value</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>

Cells boundaries indicate year when each one of EA16 countries joined the Euro Zone.

Data for the year 1997 are provided for reference purposes since the initial assessment was performed in 1997 before the introduction of the Euro. Cells shaded in grey indicate years when EA countries did not comply with the public debt Maastricht convergence criterion.

**Does the Shape of the Yield Curve Influence the Call Premium on Corporate Bonds?**  
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**Abstract**

Much of today's corporate debt is callable and the value of the call provision attached to a corporate debt instrument is a function of the likelihood of the call provision being exercised by the bond issuer. This study examines the effect of the shape of the yield curve on the call premium placed on callable bonds over similar non-callable bonds. Since a bond issuer will only call a bond when interest rates are currently lower than they were at the time of the bond's issue, then the likelihood of a call being exercised will increase as interest rates are expected to decline over time. The market conveys its expectations about the future direction of interest rates by the way it prices fixed income securities. This expectation is reflected in the shape of the yield curve on government debt. If the yield curve is upward sloping, then the market is conveying its expectation that, over time, interest rates will rise. This would represent a set of expectations that reduce the likelihood that a call would be exercised, reduce the call premium, and drive the price of the callable issue closer to the price of similar non-callable issues. Conversely, if the yield curve is downward sloping, then the market is conveying its expectation that, over time, interest rates will decline. This would represent a set of expectations that increase the likelihood that a call would be exercised, increase the call premium, and drive the price of the callable issue below the price of similar non-callable issues.

**Introduction**

Corporate bond yields are a function of several factors generally assumed to be additive in nature. First, bonds yields compensate investors for the act of deferring consumption today in favor of increased consumption at some later time. Investors will not defer consumption today in

return for the same consumption at a later time. It is only the expectation of greater future consumption that will prompt an individual to defer consumption to a future time. Additionally, compensating an investor for deferred consumption alone is insufficient for prompting investment. Purchasing power must also be preserved. For example, if an investor requires 3% to defer consumption for a year, and prices during the year rise by 3% then a 3% rate of return, which would cover the deferral of consumption, results in zero gain to the investor and they have essentially deferred consumption for nothing. Inflation is unknown until after the fact. Therefore, the extra amount required to compensate for inflation is based on the expectation of the average level of inflation over the corresponding holding period. This inflation premium is common to all securities.

Bond contracts often contain various covenants that are designed to benefit one party or the other to the agreement. Most indenture provisions are designed to make the bond more attractive to the bondholder and thus enhance the price and lower the yield. For example the imposition of restrictions on the firm such as a non-subordination provision will cause the market to perceive the bond as less risky, more attractive and thus more valuable. This results in downward pressure on the interest rate that the issuer will be required to agree to over the life of the bond. [Jones (1998)]

Another contract element that one might find in a bond contract is the conversion right. The conversion right gives the bondholder the option to convert the bond into a specified number of shares of the company's stock. This has the theoretical effect of a call option to the bondholder on the company's stock and allows the bondholder to participate in share price appreciation resulting from the company's investments if they so desire.

For example: A bond is sold in the primary market for its face value of \$1,000. At the time the bond is issued, the issuing company's stock is trading for a price of \$40 per share. The bond contains a conversion privilege that allows the bond holder to convert the bond to 20 shares of stock (the conversion ratio). Since this conversion ratio remains constant, the bondholder now has a call option on the company's stock at a strike price of \$50 per share ( $\$1,000/20 = \$50$ ) and the option is currently out of the money (strike price > market price).

Most convertible bonds are issued with the conversion option "out of the money" for obvious reasons.<sup>1</sup> However, if the market believes that price appreciation in the company's stock is likely to occur, then the value of the conversion option will increase the value of the bond. This will lower the yield that the market requires on the convertible bond. (Jones 2001)

The call provision, which allows the issuer to redeem the bond early in the event of a lower interest environment, has been associated with lower bond prices and higher yields. [See for example: Allen, Lamy and Thompson (1990), and Jones (2001)]. The current study will examine the continuing effect of these contract elements on yield premia. Since the value of the call option on the bond accrues to the borrower (issuer), it is exacted from the lender (bondholder). If the value of the option increases, then the value of the callable bond declines in similar fashion.

For example, if we compare two bonds that are identical in every aspect except that one is callable and one is not, then the difference in their market values must be attributable to the call option. However, the value of the call option actually has two components: the dollar value of the option, and the likelihood that the option will be exercised. As noted earlier, the call option is only valuable to the issuer when interest rates are lower than they are currently paying. Therefore, the expected value of the call option will increase as current interest rates differ on the



low side from the interest rate on the bond. This is why finance professors often note to students that bonds that are trading at a discount to face value (i.e. market rates are above the coupon rate) are not likely to be called. In this instance, the value of the call option is essentially zero because the likelihood of the option being exercised is essentially zero.

As the market expects interest rates over time to decline (as indicated by a downward sloping yield curve) then the likelihood of a future call increases, and the price of the callable bond should fall below that of the otherwise identical non-callable bond.

### **The Model**

To examine the effect of the shape of the yield curve on bond yield the following model is specified.

$$YLD = \alpha + \sum \beta_i CV_i + \delta Slope$$

Where YLD is the yield on the issue reported on the issue date. The  $CV_i$ 's represent a vector of control variables included as the result of theory and prior empirical work. These control variables include call protection, term to maturity, issue size, issue rating, presence of a conversion option and whether the issue is dually or split rated<sup>1</sup>.

The **slope** variable is the slope of the characteristic line through the yield curve on the day the bond was issued. This variable is used as a proxy for the likelihood of a bond call being exercised by the issuer. It is assumed that a bond issuer would not exercise a call provision in an environment of higher interest rates than those that exist at the time the bond is issued and conversely, that conditions of falling interest rates will increase the likelihood that a call option

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<sup>1</sup>See Allen, Lamy and Thompson (1990), Altinkilic and Hansen (2000), Billingsley, Lamy, Marr and Thompson (1985), Blackwell, Marr, and Spivey (1990), Chatfield and Moyer (1986), Ederington (1986), Jewell and Livingston (1998), Liu and Moore (1987), Livingston et al. (1995) Logue and Rogalski (1979) Sorensen (1979), Rogowski and Sorensen (1985), and Livingston and Miller (2000).

will be exercised. In this case, the bond issuer would be able to exchange higher interest cost for lower interest cost.

If the issue is callable prior to maturity a binary indicator variable (**Callable**) is given a value of 1, otherwise it is set to zero. The interaction of the call variable and the yield slope variable will inform the results of this study and is included in the analysis because the ability to call an issue early represents an option to the issuing firm that has a positive value which will accrue from some other party, in this case, the purchaser of the bond. In addition, the ability to call the issue early raises the possibility that under conditions of falling market rates, the very condition under which the holder of the bond will want to keep it, the bond issue may be prematurely recalled forcing the holder to reinvest at a lower rate (reinvestment rate risk). These arguments suggest that the relationship between the call grouping variable and a bond's excess yield should be positive. The greater the likelihood that the bond will be called the higher the return required by the investor interested in buying the issue.

**Term** is the number of years to maturity of the issue. This variable is included as a proxy for interest rate risk. Interest rate theory suggests that interest rate risk rises with term to maturity. Therefore, it is expected that longer term issues will have a higher required yield than shorter term issues to compensate for the additional interest rate risk. The model is tested with both the nominal value in years for the term variable as well as the natural log of the term variable

**Size** is the proceeds of the issue in dollars. This variable is included as a proxy for the liquidity risk of the issue. Fisher (1959) suggests that the amount of debt issued will have an impact on the liquidity risk of the issue. This impact can be either positive or negative. Larger issues may be traded more frequently thus reducing the liquidity risk of the issue or a large issue

may have a negative price impact increasing liquidity risk. The model is tested with both nominal value in millions as well as the natural log of the size variable.

Default risk is proxied by the issue's Standard and Poor's rating. While each issue in the sample has a rating from both Moody's and Standard and Poor's, previous work by Jones (1998) suggests that the market places greater weight on the rating of Standard and Poor's, therefore, the S&P rating is used to categorized issues with respect to default risk. The issues are placed into one of four default risk groups. The four groups are: **Very High Grade** (AAA), **High Grade** (AA to A), **Medium Grade** (BBB) and **Speculative** (BB+ and lower). Three indicator variables are assigned a value of 1 or 0 depending upon in which category the issue's S & P rating falls. The Speculative grade issues will have a value of 0 for all three, Medium grade would be coded as 0,0,1; High grade as 0,1,1; and very high grade as 1,1,1. Indicator variables are used as opposed to a continuous variable because the ratings represent categories of risk rather than a continuous risk measurement. That is that AA is not more risky that AAA by some fixed amount.

**Split** is an indicator variable set equal to one if the issue is rated differently by Moody's and Standard and Poor's and zero otherwise. Billingsley et. al. (1985) examined 258 bonds issued between January 1977 and June 1983, 12.9% of which were split rated. Their study found that investor's perceive split rated issues as more risky than non split rated issues. It is therefore expected that split rated issues will have a higher yield than non split rated issues [See also Ederington (1986), Liu and Moore (1987) and Jones (1998)].

**Conv** is an indicator variable that will have a value of one if the issue is convertible prior to maturity at the option of the holder and zero otherwise. The option to convert the bond into shares of stock acts fundamentally the same as a call option on the issuer's stock at a strike price

equal to the conversion price of the bond. Jones (2001) examined whether or not the bond purchaser places a value on the conversion option. Theory suggests that the added option value of the conversion privilege would increase the price that an investor would be willing to pay for a particular issue which would have the effect of lowering the required yield. Jones (2001) work supported this theoretical construct finding that in his sample convertible bonds had an average excess yield lower than non convertible bonds.

## Data

The dataset for this study consists of 5,337 new corporate debt issues made between 1983 and 1993.<sup>2</sup> Information on the slope of the yield curve was derived from data downloaded from the Federal Reserve Board's H15 interest rate series.<sup>3</sup> A general description of the data is found in tables 1 and 2 below. Thirty-four % of the issues were callable, 7.8% were convertible, and 21.9% were split rated. All risk classifications were well represented. The average dollar value of the issues in the sample was \$139.75 million and they ranged in size from \$100,000 to \$2.26 billion. The average issue had a yield of 9.62% and they yielded on average 369.37 basis points above the rate on contemporaneous 3-month treasury bills. The callable issues were on average protected from being called for a period of 1.35 years and this ranged from immediately callable to call protected for 20 years.

Table 1. Frequencies of Category Variables N=5337		
Variable	Number	%
Callable	1816	34.0%

<sup>2</sup> This dataset was created originally by T. Opler from data acquired from the Federal Reserve Board of Governor's Capital Markets Division. The data was acquired by the author from the Fisher College of Business datafinder website in 1996. The dataset has subsequently been removed from that site.

<sup>3</sup> <http://www.federalreserve.gov/releases/h15/update/>

Convertible	415	7.8%
Split	1169	21.9%
Very High Grade	269	5.04%
High Grade	2769	51.88%
Medium Grade	1126	21.10%
Speculative Grade	1173	21.98%

Table 2. Descriptive Statistics of Continuous Variables N=5337				
	Minimum	Maximum	Mean	Std. Deviation
SIZE	.1000	2260.0000	139.748698	122.0392763
Term	1.0000	99.0000	14.882518	10.0015304
YLD	3.4500	19.8900	9.621316	2.3004184
XYTB03 (%)	.0000	14.2700	3.693705	1.9016415
CP	.0000	20.0000	1.350009	2.5649064
Oty (basis points)	.00	1427.00	369.3705	190.16415
Valid N (listwise)				

## Results

Results will be provided at the conference.

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<sup>1</sup> If the bond were issued with the conversion option "in the money," then investors would buy the bond and convert it to stock and make a riskless profit. This would drive the price of the bond up until the conversion call option is approximately "at the money."

# Fortifying Proposal Selection Using Payback

by

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## Abstract

According to the literature, the payback period method is often used along with net present value (NPV) and internal rate of return (IRR) for evaluation of capital projects. Despite its simple and intuitive approach, the payback method has been criticized in the literature for its failure to consider the cash flows beyond the payback period. Since it is difficult to project future cash flows accurately, investment proposals with a short payback may be more attractive to the practitioner than suggested by NPV or IRR. In addition, growth rates are very common to the vernacular of business, so there may be particular advantage to incorporation of cash flow growth rates into the calculation of the payback period. A two fortified payback calculations can be used to summarize projected future cash flows, and they are easily to compute. The first is based on the ratio of the initial outlay to the first period cash flow and the projected cash flow growth rate. The resulting payback periods behave as one would expect with respect to this ratio, varying growth rates and the subsequent augmentation of the computation to include discounted cash flow.

## Introduction

In choosing a capital budgeting decision tool, academics recommend net present value (NPV) as the primary tool followed by the internal rate of return (IRR) measure. The payback period method is also presented but is treated as a decision aid.<sup>1</sup> As a decision tool, the payback period measure is typically regarded as intuitively appealing but with little practical relevance due to its shortcomings. The payback method has been criticized in the literature for its failure to consider the time value of money and also for ignoring cash flows that occur after the payback period. (Block and Hirt [2005] and Rushinek [1983]).

Despite the limitations of the payback and discounted payback measures, Graham and Harvey (2001) find that firms *do* use these methods in evaluating capital budgeting decisions. In a survey of 392 CFOs, Graham and Harvey find that 56.7% (always or almost always) use the payback period. In addition, large firms prefer present value techniques while small firms prefer the payback period criterion. Considering that smaller firms may face greater risk due to a lack of diversification, it makes sense that they tend to care more about downside risk, which would make payback a more appealing choice.

If the payback period method is inferior relative to present value techniques, why are firms still using it as a primary decision tool? While the payback period may be less sophisticated, its continued use suggests that managers find some value in its results. This paper suggests that the payback period may be a more useful measure with some augmentation or fortification. We suggest a simple method for calculating a payback period assuming that cash flows are expected



to grow at a constant rate. This method of payback period calculation attempts to quantify management perspective as to why the payback period measure is useful in capital investment decisions. It is shown that a payback period can be used to summarize projected future cash flows by capturing two primary factors of cash flows, namely, the ratio ( $I$ ) of initial outlay to the next period projected cash flow, and the projected cash flow growth rate ( $g$ ). Knowing that the payback period is positively associated with the ratio  $I$  and negatively related to  $g$ , the management can better assess a trade-off between the cost and the gains of the project.

It is shown in the paper that that the formula for the payback period is the same as the formula for the Future Value Interest Factor for an Annuity (FVIFA). This study is also extended to incorporate discounted cash flows to adjust for the time value of money. Interestingly, the discount rate acts like a negative growth rate in determining the payback period when cash flows exhibits exponential growth.

The paper is organized as follows. In sections two and three, the payback period calculation is presented with the assumption of constant growth in cash flows, with and without discounting, and explicit closed form solutions for the payback period are provided. Section four provides concluding remarks.

### **Payback period with constant growth and without discounting**

The measure developed below approaches the payback model using a cash flow perspective and assumes that cash flows are expected to grow at a constant rate. Stock valuation techniques often make this assumption that dividends will grow at a constant rate and based on that assumption a stock price can be determined. The choice of the growth rate is subjective but suggests that earnings will grow at some rate and ultimately translate into dividend growth. Therefore, the choice of growth rate,  $g$ , is based on knowledge of how much a firm's earnings will grow and the amount of earnings retained and reinvested, inflation, and/or the rate of return a company earns on its equity.

This same logic is applied to the payback period measure with a constant growth assumption; the choice of  $g$  requires knowledge of the firm's activity and foresight. The assumption of constant growth is reasonable for several reasons including the difficulty in forecasting cash flows beyond a certain point, especially among small firms, and the cash flows generated from a particular product or project life cycle being uncertain. The decision to incorporate exponential growth can be justified on the same basis as the geometric progression used in the Gordon constant growth stock valuation model, even if the validity may remain an empirical question. Using the same constant growth assumption and the same geometric progression as in other models, we show that the payback period is simply the Future Value Interest Factor for an Annuity (FVIFA) capturing the primary factors of  $I$  and  $g$ .

### **Model Development**

The payback period,  $T$ , is the length of time it takes to recover the initial investment of a capital investment proposal. In this initial discussion, the first period cash flow is assumed to be \$1, so this ratio,  $I$ , will be the initial investment divided by 1, or simply the initial investment.

An additional assumption is that cash flows subsequent to the first period are expected to increase at a constant rate of  $g$  percent per period. Since the payback period,  $T$ , is the length of time to recover the initial investment,  $T$  can be determined using Equation (1).<sup>2</sup> The payback period,  $T$ , satisfies the following:

$$\sum_{t=1}^T (1 + g)^{t-1} = I \quad (1)$$

Note that the left hand side of the equation is exactly the future value of an annuity at the interest rate of  $g$  % and  $T$  periods. Indeed, the annuity value can be obtained as  $(1 + g)^{T-1} + (1 + g)^{T-2} + \dots + (1 + g)^2 + (1 + g) + 1$ , while the sum in Equation (1) is  $1 + (1 + g) + (1 + g)^2 + \dots + (1 + g)^{T-2} + (1 + g)^{T-1}$ .

The payback period  $T$  can be easily found using a factor to calculate the future value of an annuity. Using common terminology, this Future Value Interest Factor for an Annuity (FVIFA) with interest rate  $g$  for  $T$  periods must be equal to the initial investment  $I$ .

$$FVIFA(g\%, T) = I$$

Alternatively, explicitly solving for  $T$ , Equation (1) can be rewritten as:

$$I = \frac{(1+g)^T - 1}{g} \quad (2)$$

Then, the equation can be transformed using natural logarithms and  $T$  to obtain Equation (3).<sup>3</sup>

$$T = \frac{\ln(1+Ig)}{\ln(1+g)} \quad (3)$$

Thus we have a closed form solution for the payback period formulated on the basis of ratio of the dollar size of the initial investment to the dollar size of the first period's net cash flow.

Suppose a project requires an initial investment of \$1,000, the expected cash flow for the first period is \$100, and the subsequent cash flows are expected to grow at 7%. The work above assumed that the initial cash inflow was \$1. Now, it is the ratio of the size of the investment to the first year cash flow that becomes important. Here, the ratio of the initial investment to the expected first period cash flow is 10, so  $I = 10$  and  $g = 0.07$  or 7%. Using the *FVIFA*, we need to find  $T$  satisfying:

$$FVIFA(7\%, T) = 10$$

From a standard *FVIFA* table,  $T$  is close to, but a little less than 8 periods. Using Equation (3),  $T = 7.843$ .

Three figures are presented to illustrate relationships among the payback period,  $T$ , the growth rate,  $g$ , and the ratio of the initial investment to the expected first period cash flow,  $I$ . Parameter values for figures are chosen to get a wide range of payback periods, from 1 to 30.<sup>4</sup> The growth rate per period,  $g$ , ranges from -5% to 30% and the investment to first period cash flow ratio,  $I$ , ranges from 1 to 15. Figure 1 plots payback periods for different growth rates and values of  $I$  in

three dimensional space. The payback period increases with  $I$ , and decreases with  $g$ . To better understand fundamental aspects of those relationships, two additional plots are provided.

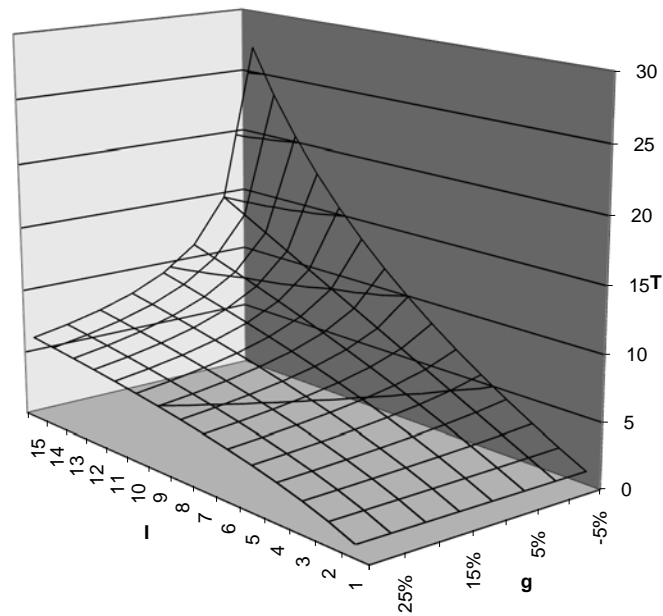


Figure 1: Payback Period  $T$ , Ratio  $I$ , and Growth Rate  $g$

Figure 2 plots the relationship between payback period,  $T$ , and the investment to first period cash inflow ratio,  $I$ , for given values of growth rate  $g$ . As  $I$  becomes larger, the payback period increases. The rate of increase depends on the value of  $g$ . When the growth rate  $g$  is negative, the payback period increases exponentially as the ratio  $I$  becomes larger and the payback curve is convex in shape.<sup>5</sup>

When the growth rate  $g$  is zero, the payback period increases proportionally with  $I$  where  $T = I$ , reflecting a linear relationship. However, when the growth rate  $g$  is positive, the slope of the payback period decreases monotonically and the shape becomes concave. The degree of concavity increases as the growth rate  $g$  increases, thereby demonstrating that the increase in the payback period  $T$  is diminished at increasingly high growth rates. In other words, the rate of change in payback period becomes smaller.

Figure 3 shows relationship between the payback period  $T$  and the growth rate  $g$ , given specific values of the ratio  $I$ . As the growth rate  $g$  increases, the associated payback period decreases. Indeed, the payback period  $T$  decreases exponentially when ratio  $I$  is large. In other words, the shape of the payback period curve becomes more convex as the ratio  $I$  increases. This indicates that the reduction in the payback period  $T$  as the growth rate  $g$  increases becomes more pronounced at higher levels of  $I$ .

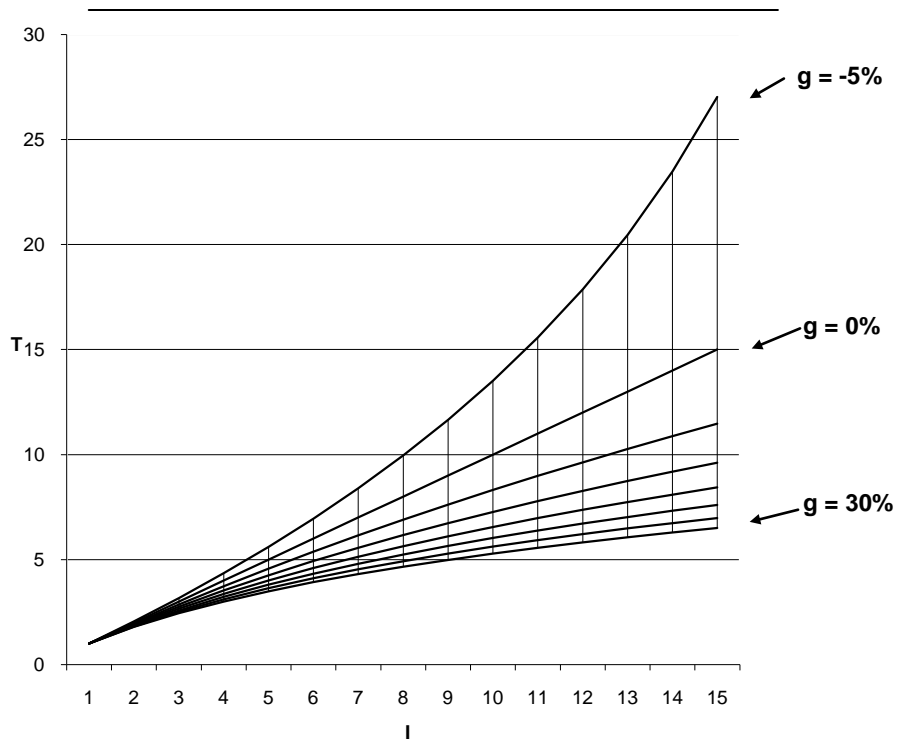


Figure 2: Payback Period  $T$  vs. Ratio  $I$

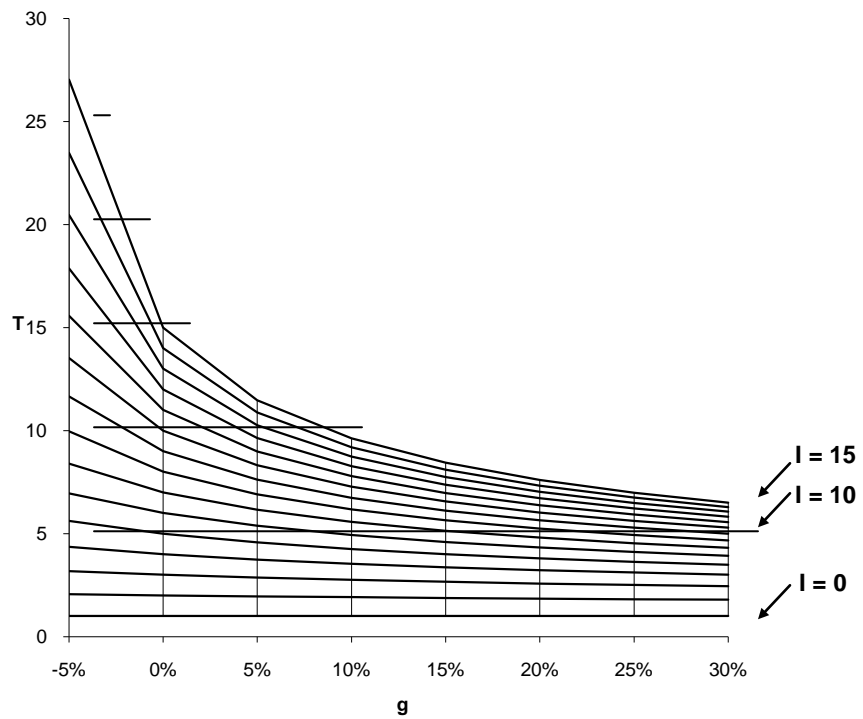


Figure 3: Payback Period  $T$  vs. Growth Rate  $g$

In summary, the payback period is positively associated with the ratio  $I$  and negatively related to  $g$ . When  $I$  is high, the cost of initial investment relative to the expected first period cash flow is high. Thus, it would take a longer time for an investor to recover the initial investment. Conversely, when  $g$ , the growth rate of the expected cash flows is high, it takes a shorter time for an investor to recover the initial investment. The shape of the three dimensional diagram reflects more complex non-linear, yet sensible, relationships among  $T$ ,  $I$ , and  $g$ .

Our finding in this section indicates that that a payback period captures two primary factors charactering the projected cash flows,  $I$  and  $g$ . The relationships among  $T$ ,  $I$ , and  $g$  allows investors to consider future cash flows beyond the payback period even if a payback is only explicitly determined based on the cash flows up the payback period. We also interpret our analysis in the context of a price-earnings approach, as it can be thought of as measuring the number of periods it takes for a stock price to be paid for by earnings as Graham and Harvey (2001) described. In our paper,  $I$  and  $g$  can be thought of as a projected P/E ratio and a projected earnings growth rate respectively. An investor can recover the investment in a stock more quickly as the projected P/E ratio is lower and the projected earnings growth rate is higher.

### **Payback period with discounting**

One of the criticisms in the use of the payback period for decision making is that time value of money is not considered. In this section, expected cash inflows are discounted back to the time of the initial investment. Again, the logic of the Gordon Growth model is applied. With discounting, Equation (1) can be slightly modified and be rewritten as in Equation (4),

$$\sum_{t=1}^T \frac{(1+g)^{t-1}}{(1+r)^t} = I \quad (4)$$

where  $r$  is the discount rate per period. The exact payback period  $T$  in this case can be calculated as,

$$T = \frac{\ln(1+I(g-r))}{\ln\left(\frac{(1+g)}{(1+r)}\right)} \quad (5)$$

In fact, Equation (5) is a special case of Equation (3) when  $r = 0$ .

Suppose the project described earlier has an *appropriate* discount rate of 5%, then  $T$  becomes 9.663, which is greater than the 7.843 payback period calculated without discounting. This is intuitively correct. When future cash flows are discounted, it takes longer to recover the initial investment of \$1,000.

Alternatively, Equation (4) can be approximated as,

$$T \approx \frac{\ln(1+I(g-r))}{\ln(1+(g-r))} \quad (6)$$

According to Equation (6), when  $g$  is not equal to  $r$ , the payback period  $T$  can be estimated using an "adjusted growth rate,"  $(g - r)\%$  with the discount rate being considered as a negative

growth rate. The payback period for our sample investment proposal based the Equation (6) is 9.27.<sup>6</sup>

### **Summary and Conclusions**

In this paper, a simple way to determine a payback period is presented when the cash flows are expected to grow at a constant rate, with and without time value of money being considered. Given the constraints of forecasting and imperfect foresight of project-based cash flows, the constant growth rate model with a finite number of periods is reasonable. Constant growth is employed in other popular financial valuation models, including the dividend discount model.

We show that a payback period can be used to summarize projected future cash flows by capturing two primary factors of the cash flows, namely, the ratio ( $I$ ) of initial outlay to the next period projected cash flow, and the projected cash flow growth rate ( $g$ ). The payback period is positively associated with the ratio  $I$  and negatively related to  $g$ . Under these conditions, it is also shown that the payback period is a Future Value Interest Factor for an Annuity (FVIFA). The study was also extended to incorporate discounted cash flows to adjust for the time value of money. In this situation and with exponential cash flow growth, the discount rate acted like a negative growth rate in determining the payback period.

Future development of these ideas could include a focus group of practitioners to determine whether these augmentations are viewed as valuable in the capital budgeting decision making process. On a more academic level, the approach in this paper could be used to estimate to apparent payback periods in various industry groupings. It would also be interesting to investigate the relationship between constant growth rate investment proposals accepted under present value methods and those selected by payback findings in both cross-sectional and longitudinal analyses.

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<sup>1</sup> Anderson and Prakash [1990] argued that the payback period could be envisioned as a project duration, and the payback method provided the same investment decision as the NPV under a specific form of cash flow progression. Boardman, Reinhart, and Celec [1982] supported the use of the payback method when faced with declining financial liquidity. Block and Hirt [2005] commented that most corporations use a maximum time horizon of three to five years in corporate planning, and a rapid payback might be particularly important to firms in industries characterized by rapid technological developments.

<sup>2</sup> The first period cash flow is normalized to \$1 for simplicity. As long as the future cash flows grow at a constant rate, only the relative size difference between the initial investment and the first period cash flow matter.  $g$  is a decimal number, but referenced as a percentage number as well for convenience.

<sup>3</sup>  $\ln$  stands for the natural logarithm function. To solve for  $T$ , a logarithmic function with any base would work. However, the natural logarithm works best to approximate values around  $\ln(1)$ .

<sup>4</sup> This study employs annual time periods. Thus,  $T=30$  implies 30 years.

<sup>5</sup> Even if the growth rate  $g$  is negative, the payout of the investment project is still positive.

<sup>6</sup> The approximate payback period with discounting can also be obtained based on the F IVFA table with the adjusted growth rate  $(g - r)\%$ .

# **Electronic Health Records: Improving Patient Safety and Quality of Care in Texas Acute Care Hospitals**

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## **ABSTRACT**

Electronic health records (EHRs) have been proposed as a sustainable solution for improving quality of medical care. This study investigates how EHR use, as implemented and utilized, impacts patient safety and quality performance. Data include nonfederal acute care hospitals in the state of Texas. Sources of data include the American Hospital Association, the Dallas Fort Worth Hospital Council, and the American Hospital Directory. The authors use partial least squares modeling to assess the relationship between hospital EHR use, patient safety, and quality of care. Patient safety is measured using 11 indicators as identified by the Agency for Healthcare Research and Quality (AHRQ) and quality performance is measured by 11 mortality indicators as related to 2 constructs: conditions and surgical procedures. Results identify positive significant relationships between EHR use, patient safety, and quality of care with respect to procedures. The authors conclude that there is sufficient evidence of the relationship between hospital EHR use and patient safety, and that sufficient evidence exists for the support of EHR use with hospital surgical procedures.

**Keywords:** Healthcare informatics, quality, electronic healthcare records, patient safety, partial least squares

## **1. INTRODUCTION**

Hospitals invest in information technology to lower costs and to improve quality of care. However, it is unclear whether these expectations for information technology are being met. Current literature asserts the imperative need to improve quality of care and patient safety in the United States (Kohn et al. 2000; Bloom 2002; Case et al. 2002a). The death toll of patients due to preventable medical errors ranks as the sixth leading cause of death in America with

approximately 100,000 patients dying each year (Kohn et al. 2000; Zhan and Miller 2003). This puts the mortality rate due to medical errors ahead of diabetes, liver disease and pneumonia. Additionally, there are 1.4 million hospitalizations a year that result in a medication-related injury (Kohn et al. 2000; Case et al. 2002b). Several studies have recognized the tremendous room for growth in the use of health information technology (HIT) to enhance patient care quality and safety (Ammenwerth et al. 2002; Bates 2002; Brooks et al. 2005; Plebani 2007). Specifically, the availability of information technology (IT) applications in hospitals has been identified as a means of improving patient safety and reducing the number of adverse events (Birkmeyer et al. 2000; Gaba 2000; Institute of Medicine 2001; Remus and Fraser 2004). In particular, electronic health records (EHR) have been touted as having significant benefits, such as productivity and efficiency gains, and the ability to improve patient safety and quality of care (Baron 2007; Connors 2007; Berk et al. 2008; Crane and Crane 2008; Eden et al. 2008; Ketchum 2008; Smith and Kalra 2008).

In that spirit, our study investigates the impact of EHR usage and utilization on quality performance and patient safety. There is currently an absence of empirical evidence showing EHRs impact on quality performance and patient safety. In addition, the findings of this research inform healthcare administrators about the return of usage and utilization of costly HIT investments. Finally, provisions on the subsidies provided by government for capital investments can be influenced by the impact of EHR usage on healthcare quality.

## **2. EHRs IN HEALTHCARE**

Electronic health records are defined as a longitudinal collection of electronic health information about individual patients and populations. It is ‘a mechanism for integrating health care information currently collected in both paper and electronic medical records (EMR) for the

purpose of improving quality of care' (Gunter and Terry 2005). This may include information regarding a patient's medical history of illnesses, digital radiology images, list of allergies, billing records, etc. Keeping medical records electronically has noted advantages over paper records, such as increased accuracy, decreased medical errors (e.g. diagnosis and prescription related fatal errors) and mortality rates, improved efficiency and productivity, lowered costs and better, safer, more equitable care (Baron et al. 2005; Basch 2005; Leipold 2007). The anticipated benefits of EHR are so vast that policy makers have called for universal EHR adoption by 2014, and current scholarly literature has given much attention to the potential improvements in quality of care by EHR implementation. Studies have predicted that EHR will help in the reduction of medication errors (Shortliffe 1999; Thompson and Brailer 2004; Linder et al. 2007) and in the improvement of quality of health care services (Miller and Sim 2004; Fonkych and Taylor 2005).

While literature recognizes the potential life-saving benefits of EHR in healthcare, their actual impact on and relationship to patient outcomes is still unclear. The majority of EHR literature available takes a management perspective and concentrates mainly on adoption, implementation, acceptance and barriers (Overhage et al. 2001; Ash and Bates 2004; Miller and Sim 2004; Chiang et al. 2008; Withrow 2008; Zandieh et al. 2008). However, research that examines the actual impact that EHRs have in the healthcare system is sparse. While some previous research examined the relationship between EHRs and quality (Spencer et al. 1999; Kinn et al. 2001; Asch et al. 2004; Linder et al. 2007; Kazley and Ozcan 2008), the most common examples of empirical analysis have been case studies that examine specialized sample populations of healthcare (i.e. VHA, ambulatory, labor and delivery, etc.), or utilize small sample sizes and qualitative evidence with limited generalizability (Kinn et al. 2001; Asch et al. 2004;

Miller et al. 2005; DesRoches et al. 2008; Eden et al. 2008; Edwards et al. 2008; Smith and Kalra 2008). Furthermore, the outcomes of interest vary using limited measures of quality (i.e. medication error rate, adherence to protocol, specified illnesses).

This study progresses research by expanding EHR investigation to include operational outcomes of acute care hospitals. A conceptual model showing the relationships between the constructs used and other components is given in Figure 1. Specifically, the inclusion of quality and patient safety metrics that have been developed and validated by the Agency for Healthcare Research and Quality (AHRQ) and utilized in previous healthcare research will broaden the scope of knowledge. These measures will allow us to answer the question, “Can EHRs increase quality and patient safety in acute care hospitals?” Additionally, we advance current research by introducing physician usage into the EHR variable and by analyzing hospital EHRs that have been categorized into four functional groups: patient information data, results management, order entry and decision support. To date, studies have focused on the availability of EHRs, with limited attention towards the varying functions within an EHR or the degree to which doctors are utilizing those functionalities (Simon et al. 2008). However, the absence of both have been noted limitations of relevant literature (Linder et al. 2007; Kazley and Ozcan 2008).

### **3. THEORETICAL FRAMEWORK**

Some previous research has examined the relationship between EHR implementation and quality. Asch et al. 2004 studied the quality of care for patients at the Veteran’s Health Administration (VHA) and found the VHAs EHR system to be associated with higher levels of patient care quality. Also contributing to quality, Spencer et al 1999 reported that EHRs combined with continuous quality improvement lead to drastic improvements in documentation and screening at a clinic in Eau Claire, Wisconsin.

EHRs are predicted to make the process of health care more standardized and automated through the presence of screen prompters, mandatory patient information fields to be entered, and tools to catch prescription interactions or inappropriate diagnoses (Shortliffe 1999; Miller and Sim 2004). These improved automated processes are expected to lead to fewer medical errors and oversights, thus improving health care quality performance and patient safety. Proponents of EHRs claim that they will reduce medical errors by ensuring that physicians follow protocol and through the decrease of adverse prescription use based on an automated interaction detection and through automated access physicians may have to patient laboratory and other diagnostic results (Medicine 2001; Ash and Bates 2004; Thompson and Brailer 2004). Further, EHRs will eliminate mistakes that occur based on illegible handwritten medical records. EHRs allow providers immediate access to patient information, are connected to a library of medical information, and often generate reminders or indications of important or time-sensitive clinical information (Miller and Sim 2004; Thompson and Brailer 2004; Linder et al. 2007). These EHR systems also enable clinicians within the same facility to access and edit medical records for a patient immediately instead of having to wait for a paper record; thus, changing provider communication and coordination of care for teams of physicians (Kazley and Ozcan 2008).

It is through these changes in the process of care achieved by utilizing EHRs that we will see improved health care quality performance and increased patient safety. Therefore, we hypothesize that:

H1: EHR implementation and usage in hospitals improves the mortality rates based on common medical conditions.

H2: EHR implementation and usage in hospitals decreases the mortality rates based on surgical procedures.

H3: EHR implementation and usage in hospitals will enhance patient safety.

## **4. CONSTRUCT DEVELOPMENT**

### **4.1 Electronic Health Records**

Electronic Health Records (EHR) is operationalized in this study using data collected from the American Healthcare Association's annual survey. Hospitals were surveyed regarding the presence of an EHR and the implementation status of the EHR (fully or partially implemented). Further, EHRs were dissected into four categories: Patient-level information data, Results management, Order entry management, and Decision support. Hospitals Information pertaining to the implementation of each category of EHR was then assessed as fully implemented, partially implemented, or not implemented. Finally, the percentage of treating physicians in each hospital that routinely orders medications and laboratory/other tests electronically were assessed (Table 1).

### **4.2 Quality and Patient Safety**

For purposes of this research the Agency for Healthcare Research and Quality (AHRQ) Inpatient Quality Indicators (IQIs) and Patient Safety Indicators (PSIs) were adopted to operationalize the constructs *Quality* and *Patient Safety*. The IQIs focus on the health care provided within an inpatient hospital setting and the mortality rates provided are a proxy measure of *Quality*. PSIs are a set of measures that can be used to screen for adverse events and complications that patients may experience as a result of exposure to the health care system. The PSIs provide a measure of the potentially preventable complication for patients who received their initial care and the complication of care within the same hospitalization. Provider-level

indicators are included in this study and report only those cases where a secondary diagnosis code flags a potentially preventable complication. Scientific evidence for these indicators is based on reports in peer reviewed literature. Structured literature review and empirical analyses were used to establish validity of the indicators and details regarding the development process are presented in the publication “Refinement of the HCUP Quality Indicators” available at [www.qualityindicators.ahrq.gov](http://www.qualityindicators.ahrq.gov) (AHRQ 2003).

Eleven mortality measures are utilized to examine quality of healthcare. These measures evaluate outcomes following procedures and for common medical conditions. The mortality indicators are divided into two quality constructs for analysis: procedures and conditions. All mortality measures are reported as part of this research, with the exception of carotid endarterectomy, hip fracture, and hip replacement because of the low volume of such procedures performed in our sample from the state of Texas, due to the limitation they introduce ....(why are they excluded?) (if this was driven with the data analysis, maybe putting this in the discussion section as a limitation would be better. What do you think?). The safety construct is comprised of eleven safety indicator rates. Indicators that were coded as rare, under-reported, unscreened, or obstetrical were excluded from the model as recommended by AHRQ due to possible skewing of the data. Table 2 displays the comprised indicators for each construct.

All employed IQI and PSI measures in this study, with the exception of Death in Low Mortality diagnostic related groups (DRGs), are risk-adjusted rates that reflect the age, sex, modified DRGs, and comorbidity distribution of data in the baseline file, rather than the distribution for each hospital. The use of risk-adjusted rates facilitates the ability to generalize the data and puts each hospital “on an even playing field.” The observed rate for Death in Low Mortality DRGs is measured due to the risk-adjustment transforming all hospital rates to zero.

## **5. DATA ANALYSIS AND METHODOLOGY**

The primary analysis of the relationship between EHR implementation, quality, and safety was performed using secondary data collected and compiled from three data sources. The American Hospital Association's (AHA) annual hospital survey provided information pertaining to EHR implementation, type of EHR function employed, and physician usage of EHR. The DFWHC database supplied inpatient quality indicators (IQI) and patient safety indicators (PSI) that were developed by the Agency for Healthcare Research and Quality (AHRQ). Finally, the American Hospital Directory (AHD) provided key hospital characteristics and demographic data.

In order to combine datasets, the AHA survey data of 577 Texas hospitals was reviewed. Records with incomplete or missing data were removed and EHR information was gathered for the remaining 364 hospitals. Second, demographics, IQIs, and PSIs for the Texas hospitals were extracted from their appropriate databases. The hospitals from both databases were then relationally joined to the sample from AHA and a new sample dataset was formed. All hospital information, including names, IDs, and addresses, were evaluated to ensure accuracy in the merging of datasets. Any hospital not appearing in all three data files or who could not be confidently identified as matches were deleted from the sample. Upon completion of merging and cleaning of the datasets, the sample included 253 Texas acute care hospitals.

Initial partitioning of the data revealed a significant amount of variation between public/private hospitals and government owned hospitals. Since the number of government hospitals was relatively small (44), we deleted these hospitals from the sample and no analyses were performed on them. The final sample utilized in this study was comprised of 209 Texas acute care hospitals.



## 5.1 Data Analysis

Analysis was performed using Partial Least Squares (PLS) modeling. PLS is a structural equation modeling (SEM) technique that assesses the psychometric properties of the scales employed to measure the theoretical constructs and estimates the hypothesized relationships among said constructs. While other SEM tools exist, the choice to use PLS was driven by several factors including PLS' ability to handle both formative and reflective indicators, its suitability for prediction and the exploration of *plausible causality*, the lack of multivariate normality assumption, and PLS's lower sample size requirements (Chin et al. 2003 ; Westland 2007).

## 5.2 Measurement Model

In order to explore the construct dimensions and validate the indicators as the proxies for quality and patient safety, an Exploratory Factor Analysis was run using the Principal Components extraction method with Varimax rotation. The indicators used are all validated with each indicator having factor loading value  $>0.40$ . The results from the Exploratory Factor Analysis confirmed the need to remove post-operative derangement from the Safety factor, and hip fracture, hip replacement, and carotid endarterectomy from the Quality construct. All other items loaded as predicted onto their dimensions (Table 3).

In order to test the validity and reliability of the constructs, the Rossiter (2002) procedure for scale development was followed. First, convergent and discriminate validity were determined. All factor loadings were greater than the 0.40 cutoff, with most loadings exceeding .60 (Nunnally 1967). The high factor loadings give reason to conclude that the measures have convergent validity. Discriminant validity was evaluated using the average variance extracted (AVE) calculated by the SmartPLS software. All constructs exceeded the .50 cutoff

recommended by Fornell and Larcker (1981) with the exception of conditions (AVE=.4677) and safety (AVE=.4689). However, these dimensions were found to have adequate convergent validity based on their high factor loadings (>.50) (Gerbing and Andersen 1988; Das et al. 2000), and the average variance extracted for each latent factor exceeded the respective squared correlation between factors (Fornell and Larcker 1981). Finally, reliability of the scale items were evaluated and all values fell within the acceptable range to conclude good reliability (Nunnally 1967; Van de Venn and Ferry 1980; Srinivasan 1985). Validation and reliability results can be seen in table 4. The results indicate that all the indicators used as proxies of quality and safety are valid and reliable measures.

### **5.3 Structural Model and Hypotheses Test**

The results of the overall structural model with all hypothesized paths revealed a model with adequate fit. The criterion put forth by Rossiter (2002) states that for the structural model all paths should result in a t-value greater than 2 and latent variable R-Squares ( $R^2$ ) greater than 50%. SmartPLS calculated the R-Square and t-values for the full structural model and all path t-values met the required cut off with the exception of EHR→ conditions (t-value = 1.439). As the predicted paths for the structural model are all hypothesized unidirectional relationships, all t-values, with the exception of conditions, well surpass the t-critical value of 1.645 at a 0.05 level of significance. Additionally, all R-Square values exceed the 50% threshold and therefore, adequate fit is concluded. Table 5 presents the path coefficient means, standard deviations, and t-values.

## 6. RESULTS AND DISCUSSION

The evaluation criterion for testing each hypothesis was the use of t-values for each path loading. Significant t-values for path loadings signify support for the proposed hypothesis. The cutoff criteria used was a t-value greater or equal to 1.645 for an alpha level of .05 (Hair et al. 2006). All proposed hypotheses were supported with the exception of the relationship between EHRs and conditions. However, the lack of relationship between EHR usage and the construct conditions is not totally surprising. Previous research has similarly shown little link between EHR implementation and a reduction in mortality for those patients suffering from designated clinical conditions (Linder et al. 2007; Kazley and Ozcan 2008; Zhou et al. 2009).

This study, however, advances research by looking at the mortality indicators for quality as divided into two separate constructs: surgical procedures and conditions. By dissecting the mortality indicators we are able to observe the significant positive relationship between EHRs and surgical procedures that has previously been undistinguishable. Further, this paper takes a distinct approach in evaluating hospital EHR implementation and usage that to our knowledge has not previously been utilized. By denoting the type of function available in the EHR system (decision support, order entry, results management, and patient-level data) and the degree of the function's implementation, we are able to better capture a more complete representation of the hospital EHR. In addition, the introduction of actual physician utilization of the EHR system to electronically order medications and laboratory/other tests provides an enhanced picture that prior research has yet to offer.

With the amount of money spent each year on IT, it is critical to understand what role these advancements play within the operational aspects of our healthcare system. The studies presented provide a starting point into investigations of information technology in healthcare,

specifically in the domain of electronic health records. The question was posed as to whether or not EHRs can facilitate an environment in which hospitals can provide higher quality of care and at the same time improve patient safety. The answer based on the research presented is yes; the use of EHRs has the potential to decrease mortality rates while significantly improving patient safety. These findings support that electronic health record systems are much more than record keeping devices. They include numerous features that have the potential to vastly improve health care outcomes. They provide physicians with preventive care reminders, allergy alerts, suggestions for diagnostic or treatment options, links to medical literature, computerized physician order entry, and data analysis tools that reduce medical errors and improve patient safety and quality of care.

The recent environment for health care organizations has focused attention on providing high quality of care at a containable cost. While the adoption of EHRs promises to improve clinical outcomes and increase patient safety, it is important to note that EHR systems are comprised of several functionalities that must be used in an integrated manner in order to realize their full potential (Menachemi et al. 2007). As seen in this study, it is possible to partially adopt an EHR by using only selected functionalities of the system. This, coupled with the fact that not all treating physicians in a hospital utilize an available EHR system, gives us some insight into why not all EHR adopters realize the hoped-for gains in clinical outcomes and patient safety. Therefore, measuring EHR implementation, degree of functionality adoption, and physician usage are essential in achieving the results of increased quality of care and patient safety.

## TABLES AND FIGURES

**Table 1 % Physicians Ordering Electronically**

Medications			Lab & Other Tests		
	Frequency	Percent	Frequency	Percent	
0%	171	82.2	160	76.9	
1-24%	20	9.6	26	12.5	
25-49%	4	1.9	3	1.4	
50-74%	4	1.9	5	2.4	
75-100%	9	4.3	14	6.7	
Total	208	100.0	208	100.0	

**Table 2 AHRQ Indicators included for *Quality and Patient Safety* constructs**

IQI	Procedures	PSI	Patient Safety
6	Percutaneous Transluminal Coronary Angioplasty Volume	1	Complications of Anesthesia
9	Pancreatic Resection	3	Decubitus Ulcer
11	Abdominal Aortic Aneurysm Repair Mortality Rate	6	Iatrogenic pneumothorax
12	Coronary Artery Bypass Graft Mortality Rate	7	Selected Infections Due to Medical Care
13	Craniotomy Mortality Rate	8	Postoperative Hip Fracture
<b>Conditions</b>		9	Postoperative Hemorrhage or
15	Acute Myocardial Infarction Mortality	11	Postoperative Respiratory Failure
16	Congestive Heart Failure Mortality Rate	12	Postoperative PE or DVT
17	Acute Stroke Mortality Rate	13	Postoperative Sepsis
18	Gastrointestinal Hemorrhage Mortality Rate	14	Postoperative wound dehiscence in abdominopelvic surgical
20	Pneumonia Mortality Rate	15	Accidental puncture and laceration
32	Acute Myocardial Infarction Mortality Rate, W/O Transfer Cases		

**Table 3 Study Scale Factor Loadings**

Study Scale Items	Factor Loadings
<u>Mortality</u>	
Procedures:	
AAA Repair	0.61
CABG (Coronary Artery Bypass Graft mortality)	0.88
CRANI (Craniotomy mortality)	0.81
PANCR (Pancreatic Resection mortality)	0.42
PTCA (Percutaneous Transluminal Coronary Angioplasty mortality)	0.85
Conditions:	
AMI (Acute Myocardial Infarction mortality)	0.86
AMI wo Trans (AMI with out transfer cases mortality)	0.87
CHF (Congestive Heart Failure mortality)	0.69
GI Hem (Gastrointestinal Hemorrhage mortality)	0.52
PNEUM (Pneumonia mortality)	0.60
STROKE (Acute Stroke mortality)	0.59
<u>Patient Safety</u>	
HEM (Post Operative Hemorrhaging)	0.56
RESP (Post Operative Respiratory Failure)	0.76
DVT (Post Operative Deep Veing Thrombosis)	0.75
HIP (Post Operative Hip Fracture)	0.57
SEPS (Post Operative Sepsis)	0.67
WND (Post Operative wound and dehiscence in abdominopelvic patients)	0.52
SEL (Selected Infections Due to Medical Care)	0.76
ACC_PUNC (Accidental Puncture and Laceration)	0.61
COMP_ANES (Complications of Anesthesia)	0.46
IAT_PNEU (Iatrogenic pneumothorax)	0.75
ULCER (Decubitus Ulcer)	0.64

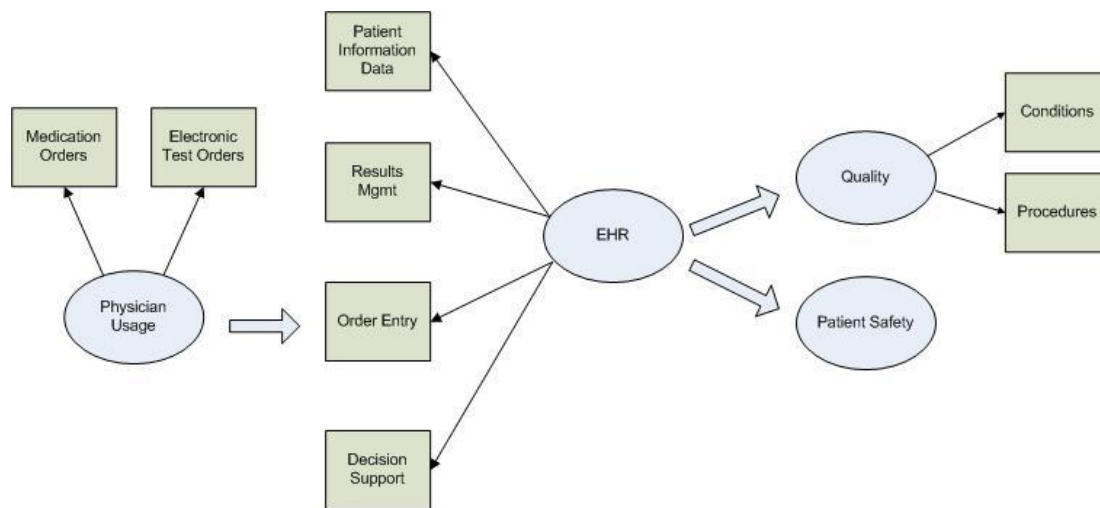
**Table 4 Construct Statistics**

Construct	R <sup>2</sup>	Composite	Cronbach's	AVE	1	2	3	4
1. EHR		0.87	0.81	0.65	<b>.81</b>			
2. Procedures	0.65	0.81	0.73	0.51	.28	<b>.71</b>		
3. Conditions	0.63	0.73	0.75	0.47	.10	.38	<b>.69</b>	
4. Safety	0.50	0.85	0.83	0.46	.34	.54	.21	<b>.68</b>

**Table 5 Construct Path Statistics**

Path	Mean	$\sigma$	t-stat
EHR → Conditions	0.1846	0.2305	1.4389
EHR → Procedures	0.3071	0.1026	2.6782
EHR → Safety	0.3811	0.0896	3.8098

**Figure 1 General Conceptual Model**



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**Southeastern Decision Sciences Institute Annual Conference  
Workshop Proposal**

**It's Not About GIS!  
A Journey to Bring a Business Location Intelligence  
Curriculum to Business Schools**

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**It's Not About GIS!  
A Journey to Bring a Business Location Intelligence  
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**Introduction**

Geographic information systems (GIS) have experienced rapid growth and user adoption since their introduction as a specialized research application in the mid-1960s. This exponential development and adoption is not unlike other software applications over the last fifteen years and is certainly a testament to vast improvements in the computational power and storage capacity of the personal computer. The benefit and value of GIS applications, once under the domain of geographic professionals, has not gone unnoticed by the business community. Business managers over the last decade have recognized how to solve many classic business problems by applying the power of specific GIS spatial algorithms, visualization tools, and optimization routines.

Numerous books have been written about the business value of GIS, for example, GIS Means Business by Christian Harder (Harder, 1997), which presents numerous case studies of how GIS helps businesses make more informed decisions and solve real world problems. John Corbett advocates in his forthcoming book, *Geographical Information Systems For The Non-Specialist*, that the term “geographical information” is too technical and should be replaced by “location intelligence” because most business executives intuitively understand the value of “location, location, location” as opposed to geographic feature sets and layers (Corbett, 2009). However, business schools are not teaching GIS to their students, which is quite surprising considering the wide spread use of GIS applications in day-to-day business activities. An informal survey of universities associated with the Southeastern Decision Science Institute indicates that only one business school out of thirty offers a GIS course (Arnette and King, 2008).

This workshop will demonstrate the value of GIS to the business community. It also covers why business schools should integrate GIS or more appropriately, business location intelligence, into existing courses or teach a dedicated GIS class.

## Workshop Content

### 1. Demonstration of several business location intelligence related text books:

*Thinking about GIS: Geographic Information System Planning for Managers* by Roger Tomlinson.

*GIS Means Business Volume 2* by David Boyles, Christian Harder.

*The Business Benefits of GIS: An ROI Approach* by David Maguire, Victoria Kouyoumijan, Ross Smith.

*Bringing Geographical Information Systems into Business* by David J. Grimshaw.

### 2. Demonstration of several business location intelligence software packages

AWhere Professional, <http://www.awhere.com/Home.aspx>

MapPoint, <http://www.microsoft.com/mappoint/en-us/MapCoverage.aspx>

ArcGIS, <http://www.esri.com/products/index.html#1>

### 3. A Business Location Intelligence Case Study

The case study and hands on demonstration will be developed from several strategic business location issues that the Virginia, North Carolina, and South Carolina port authorities encounter on a daily basis. Economic trends and competitive pressures will be translated into location intelligence problems and then visually analyzed. Seemingly complex problems will be illustrated quickly using AWhere and MapPoint, without the typical geographical information systems overhead that is associated with the environmental science focus of ArcGIS.

#### Case aspects to be covered:

Building a spatial database

- Attribute data

- Spatial data

  - Vector data

  - Raster data

- Importing spatial data

Spatial database query

- Spatial data queries

- Attribute data queries

Analysis of spatial data

- Buffering

- Overlay

# THE IMPACT OF NEGATIVE EMOTION ON PERCEIVED PRIVACY RISK IN A SOCIAL NETWORK COMMUNITY

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## ABSTRACT

A pilot study was conducted to examine current demographic and usage characteristics of users of social network communities (SNCs) and to investigate the relationship between induced negative emotion and perceived privacy risk within the context of SNCs. Analysis of survey data provided by subjects revealed that students expose themselves to significant privacy risks through their Facebook activities. Showing subjects videos detailing incidents in which users were harmed by revealing private information on SNCs significantly increased subject's negative emotions (anger and fear) and perceptions of privacy risks associated with Facebook activities.

## INTRODUCTION

Participation in online social networking communities (SNCs) has increased dramatically over the past few years, particularly among college undergraduates. A recent study reported that 78% of college students have created their own online profile on an SNC site such as Facebook.com or MySpace.com [1]. The increase in popularity of social networking sites has been accompanied by a rise in online privacy risks. Users of SNCs divulge an alarming amount of personal information about themselves, either unaware or unconcerned about the risks associated with their online disclosures.

Previous studies investigating participation in SNCs among college-age students have argued that students often misperceive, and in particular *underestimate*, the risks associated with online privacy revelation [6], [3]. Various remedies have been suggested to diminish the privacy risks associated with SNCs. These include privacy policies, technical controls, commercial data rules, use restrictions, and data ownership agreements. Gimmelman [2] contends that such strategies for limiting risks associated with SNCs will fail because they focus on the technology rather than the user. It is the user's decision to upload personal information that puts them at risk. The better informed users are about the privacy risks of online social networking "the smaller the gap between the privacy they expect and the privacy they get" [2, p.43].

In this paper, we report the results of a pilot study in which college undergraduates were initially asked about their participation in various Facebook activities, their use of privacy controls offered on Facebook.com, and their assessments of the privacy risks that they expose themselves to through their online disclosures. In a subsequent session, students were shown two YouTube

videos that document incidents in which Facebook users were harmed when personal information that they uploaded was accessed by potential or current employers. YouTube videos, rather than written reports, of the incidents were used because we believed that they were more likely to capture subjects' attention and also because videos incorporate both visual and auditory learning modalities, the primary learning modalities for 90% of the population. After watching the videos, subjects reassessed the risk of Facebook activities using the same risk assessment instrument as in the first session. An increase in perceived risk after students viewed the videos would provide evidence that users more accurately evaluate the risks of online disclosures when educated about the potential harms.

## METHOD

### Participants and procedures

Thirty-four subjects were recruited for the pilot study. Subjects were undergraduate business majors at a large public university in the southeastern United States. Subjects participated in two study sessions. In the first session, subjects provided background information including age and gender and responded to survey instruments designed to measure Facebook usage [1], and risk perceptions of different Facebook activities. In the second session, subjects were shown two YouTube videos reporting incidents where college students were harmed when they uploaded personal information that was later accessed by potential or current employers. Immediately before and after seeing the videos subjects responded to scales measuring fear and anger levels. Finally, students provided risk assessments for different Facebook activities using the same risk assessment scale used in the first session.

## RESULTS

Table 1 displays demographic information for the sample subjects. Approximately 68% of the subjects were male and the average age was almost 21 years old. All college levels were represented, although a majority of subjects were either sophomore or junior level.

**TABLE 1: DEMOGRAPHIC CHARACTERISTICS FOR A SAMPLE OF SNC USERS**

<b>Variable</b>	<b>% (Frequency)</b>	<b>Mean (SD)</b>
Age		20.9 (1.96)
Gender		
Men	68 % (23)	
Women	32 % (11)	
College status		
Freshman	3% (1)	
Sophomore	26% (9)	
Junior	50% (17)	
Senior	21% (7)	

Table 2 shows descriptive statistics for Facebook usage characteristics for the pilot study subjects. A high percentage of subjects had Facebook accounts and the number of "friends"



ranged from 14 to 3500 with a mean of 569. The majority of subjects allowed anyone to view their profile page (60%) which included their email address (70%), a picture of themselves (80%), and their real name (80%). Half of the subjects friended people they had never met. A small percentage of users included their phone number (10%) and physical address (3%). Overall, subjects knowingly provided a surprising level of personal information to a large online audience.

**TABLE 2: FACEBOOK USAGE CHARACTERISTICS FOR A SAMPLE OF SNC USERS**

<b>Variable</b>	<b>Yes%</b>	<b>No%</b>	<b>Mean (SD)</b>
Do you currently have an account on Facebook?	88%	12%	
Do you allow anyone to view your profile?	60%	40%	
Do you include a picture of yourself on your profile?	80%	20%	
Do you include your e-mail address on your profile?	70%	30%	
Do you include your instant messenger address on your profile?	24%	76%	
Do you include your phone number on your profile?	10%	90%	
Do you include your home address on your profile?	3%	97%	
Do you include information about your interests on your profile?	80%	20%	
Do you include information about your personality on your profile?	56%	44%	
Do you write on other people's profile page?	85%	15%	
Do you spend time personalizing your profile page?	40%	60%	
Do you use your real name on your profile page?	80%	20%	
Do you ever friend a person who you have not met in person?	50%	50%	
For how many years have you had your profile displayed on Facebook?			2.85 (1.52)
On a typical day, how many times do you visit your profile?			3.5 (4.6)
On a typical day, how many profiles from others do you view?			7.0 (18.0)
On a typical day, how many hours do you spend viewing profiles?			0.74 (0.60)
Approximately how many "friends" do you have on your profile?			568.7 (647.3)

Table 3 reports subjects' risk assessments for participation in Facebook activities before and after viewing the YouTube videos describe above. Each risk was rated on a seven point scale ranging from 1 = Not at all risky to 7 = Extremely risky. Table 3 reveals that their perceived risk increased for all 10 Facebook activities after seeing the YouTube videos. The increase was statistically significant for 7 of the 10 activities ( $\alpha = 0.05$  significance level).

The results in Table 3 provide evidence that subjects' risk perceptions were influenced by the messages contained in the YouTube videos. Prior research on the effects of negative emotion on risk assessment and decision making have shown that negative emotions increase risk perceptions [4] [5]. In order to test whether the YouTube videos were effective in inducing negative emotions, subjects fear and anger levels were evaluated before and after they viewed the videos using the positive and negative affect scale (PANAS) [7]. A paired-difference t-test for the PANAS showed a significant increase in subjects' levels of anger and fear, which were combined into a single measure of negative emotion (t-statistic = 3.71, p-value < .001). Following the t-test, an analysis of covariance was conducted using risk perception after viewing videos as the dependent variable, risk perception prior to viewing the videos as the covariate and increase in negative emotion and gender as independent variables. The model was significant with  $F_{3,30} = 12.06$ , p-value < .001. The negative emotion variable had a significant, positive effect on perceived risk at  $\alpha = 0.10$  (p-value = 0.0552). The effect of gender was also significant, with female subjects' risks perceptions greater than male subjects (p-value = 0.0631).

**TABLE 3: RISK ASSESSMENTS FOR FACEBOOK ACTIVITIES BEFORE AND AFTER VIEWING VIDEOS ON FACEBOOK RISKS**

Risks assessed using a scale ranging from 1 = Not at all risky, to 7 = Extremely risky.				
	Mean Before	Mean After	Mean Difference	t-statistic (p-value)
Allowing anyone to view your profile	3.62	4.74	1.12	5.12 (0.00)
Including a picture of yourself on your profile	2.44	3.03	0.59	3.27 (0.00)
Including your e-mail address on your profile.	2.94	3.59	0.65	2.52 (0.01)
Including your instant messenger address on your profile	3.12	3.74	0.62	1.99 (0.03)
Including your phone number on your profile.	5.15	5.36	0.21	0.91 (0.18)
Including your home address on your profile.	6.12	6.18	0.06	0.27 (0.40)
Including information about your interests on your profile.	1.89	2.74	0.85	4.29 (0.00)
Including information about your personality on your profile.	2.15	2.86	0.71	3.38 (0.00)
Using your real name on your profile page.	3.20	3.32	0.12	0.53 (0.30)
Friending someone that you have never met in person.	3.79	4.29	0.50	2.19 (0.02)

### CONCLUSION

The analysis of the survey data from the pilot study indicates that a high percentage of undergraduate students use online social networking communities and that many users reveal an

extensive amount of personal information on these sites. Online videos conveying messages about potential harms to SNC users were effective in increasing users' perceived risks for Facebook activities. A tentative analysis of the data provides some evidence that the YouTube videos induced negative emotions (fear and anger) in subjects which in turn caused them to perceive greater risks associated with privacy revelation on Facebook. Additional research in this area should consider the role of emotion and other factors, such as worldview, in determining perceptions of online privacy risks with the goal of providing more effective methods of informing and educating young adults about these risks.

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## OPINION MINING OF SOCIAL WEBSITE DATA

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### ABSTRACT

In recent years corporations have started exploring how to effectively use the social networks data to improve their business operations. This wealth of user-generated data can be mined to track valuable opinions, which help provide business intelligence to management. Data and text mining technologies are the key contributors to making opinion mining (OM) possible. This research aims to investigate these two mining technologies in terms of how they are applied within the broader context of OM. A range of recently published research literature on data mining, text mining, and social networks related applications is reviewed to explore OM's potential.

### INTRODUCTION

People perceive the Web increasingly as a social medium that fosters interaction among people, sharing of experiences and knowledge, group activities, community formation and evolution. This research focuses on exploring the emerging trends and business needs associated with utilizing data and text mining techniques for social networking data analysis. It investigates how one can intelligently mine the unprecedented wealth of data generated from social networks for opinions for purposes such as marketing campaigns. Some of the biggest companies – Ford, Levi Strauss and Chevron, to name a few – are reengineering marketing operations to embrace digital tools to more nimbly brand products, support customers and cash in on the social-media wave. In doing so, they are creating online communities and aggressive outreach programs.

The textual information found in social networks can be broadly classified into two main categories, *facts* and *opinions*. Facts are objective statements about entities and events in the world. Opinions are subjective statements that reflect people's sentiments or perceptions about the entities and events. Much of the existing research on text information processing has been, almost exclusively, focused on mining and retrieval of factual information, e.g., information retrieval, Web search, and many other text mining and natural language processing tasks. Until only recently, work has begun on the processing of opinions. Yet, opinions are so important that whenever one needs to make a decision one wants to hear others' opinions. This is not only true for individuals but also true for organizations.

Corporate managers are facing unprecedented changes in the way in which consumers are expressing and sharing opinions about their brands, products and services. In the past, consumers shared their views through spoken word of mouth, leading to a long period of latency before a brand's weakness or strengths were known to all. Today, users express themselves in millions of bulletin boards, blogs, and social networking site, also known as the blogosphere [2]. These sites are read by thousands – sometimes millions – of consumers who quickly form an opinion of a brand. Comments made in blogosphere can help a company reposition its products against the competition, highlighting strengths and overcoming weaknesses through an appropriate blend of advertising, marketing, and product engineering. Thus the ability of a company to perform real time OM [20] of the blogosphere – with high levels of accuracy enables it to quickly identify trends in opinions about their brands, which in turn enables managers to take appropriate actions quickly.

Data mining is a powerful technology for the automatic extraction of patterns, associations, changes, anomalies and significant structures from data. These uncovered patterns from data play a critical role in decision making because they reveal areas for process improvement. Most of the value of data mining comes from using data mining technology to improve predictive modeling [24]. Recent advances have led to the newest and hottest trend in data mining – text mining [13] [8]. Applying text mining to unstructured data adds a richness and depth to the patterns already uncovered through the company's data mining efforts. Text mining applies the same analytical functions of data mining to the domain of textual information, relying on sophisticated, text analysis techniques that distill information from free-text documents [4] [19]. Data and text mining technologies are the key contributors to making OM possible [3]. These two mining technologies are investigated in terms of how they are applied within the broader context of OM.

## **BACKGROUND TECHNOLOGIES**

### **Data Mining**

Data mining can be conceptualized as the automated extraction of hidden predictive information from databases. In other words, it is the process of analyzing large data sets in order to find patterns that can help to isolate key variables to build predictive models for management decision making.

Data mining is primarily used for competitive advantages by companies with a strong consumer focus. The focus of data mining applications amongst the business leaders has been steadily evolving from customer analytics to relationship analytics. Increasingly competitive business and consumer marketplaces make it imperative for companies not only to attract customers, but also to retain them especially that small percentage of highly profitable customers. Retention strategies for valued customers generally focus on financial and/or service-level incentives to promote loyalty. Since only few companies can enjoy the economies of scale (or investment capital) to sustain competitive differentiation on price alone, many businesses seek to maximize customer value by building loyalty through brand and service differentiation. This approach

place a premium on the quality of every customer contact as each interaction serves to either build brand or destroy it.

These business leaders use advanced analytics with data mining to optimize their customer relationships [15]. Examples include: improving the effectiveness of marketing campaigns and attracting new customers, maximizing the value of sales to existing customers (cross-selling and up-selling), minimizing customer loss (churn), credit risk scoring, and lifetime value modeling and analysis. Data mining techniques are also used to analyze and monitor levels of customer satisfaction and loyalty and diagnose the causes of changes in these levels.

There are many data mining methods for extracting patterns from data. These methods can have different goals, dependent on the intended outcome of the overall data mining process. Most data mining goals fall under the following categories: *data processing*; *prediction*; *regression*; *classification*; *clustering*; *link analysis* (associations); *model visualization*; and *exploratory data analysis*.

Any data mining method that helps to get more information out of data is useful. Different methods serve different purposes, each offers its own advantages and disadvantages. The most commonly used methods for data mining can be classified into the following groups: *statistical methods*; *case-based reasoning*; *neural networks*; *decision trees*; *rule induction*; *Bayesian belief networks*; *genetic algorithms/evolutionary programming*; *fuzzy sets*; and *rough sets*.

Different combinations of data mining goals and methods are used to ensure flexibility and the greatest accuracy possible in the process. The major benefit of data mining is that it is an aid to strategic, tactical and operational decision-making in situations where numerous variables, affecting costs or benefits, impinge on the eventual outcome of the course of action that a company might decide to take. The modeling that accompanies data mining assimilates the information on costs and benefits of alternative courses of action as visualized in the form of a familiar method such as decision trees. Companies use such information to find new opportunities for growth, choose more effective means to achieve their business goals and streamline business processes to lower their costs.

Data mining and visualization tools are used in combination to improve the usability of advanced analytics systems. The purpose of data *visualization system* is to give the user an understanding of what is going on as far as data mining models and their outputs are concerned. Since data mining usually involves extracting “hidden” information from a database, this understanding process can get somewhat complicated. Because the user does not know beforehand what the data mining process has discovered, it is much bigger leap to take the output of the system and translate it into an actionable solution to a business problem.

## Text Mining

While data mining successfully helps find the gold hidden in a company's data, it addresses only a very limited part of a company's total data assets: the *structured* information available in databases. Probably more than 90% of a company's data are never being tapped or looked at: letters from customers, email, correspondence, recording of phone calls with customers, contracts, technical documentation, patents, and so on [25]. The emergent text mining tools help dig out the hidden gold from these *unstructured* information sources. Text mining technology has lately leaped from information search and retrieval to intelligence and knowledge discovery [22].

Text mining applies the same analytical functions of data mining to the domain of textual information, relying on sophisticated, text analysis techniques that distill information from free-text documents. Text mining software operates on the digitized form of organizational textual data to provide the capability of pattern identification, visualization support to aid pattern identification, modeling support to identify or confirm relationships, and drill-down query tools to enable analysts to focus on key problem areas [6]. Report generation tools also aid the text mining process.

The text mining process typically includes the following steps: (1) preprocessing of the data to the needed format for further analysis (data preprocessing), (2) extraction of important concepts and terms through initial text analysis (concept extraction), (3) writing a narrative analysis to identify patterns and co-occurrences of identified concepts (narrative analysis), (4) developing an automated solution (automatic categorization), and (5) building a taxonomy (taxonomy building).

The technologies used in the text mining process include: information extraction, topic tracking, summarization, categorization (identifying the main theme of a document), clustering, concept linkage (tools connect related documents by identifying their shared concepts, helping users find information they perhaps wouldn't have found through traditional search methods), information visualization (puts large textual sources in a visual hierarchy or map and provides browsing capabilities, in addition to simple searching), and question answering. This list of technologies shows that the text mining technology covers two main application areas: (1) knowledge discovery (mining proper) and (2) information 'distillation' (mining on the basis of some pre-established structure) [10].

A new trend involves integration of data mining and text mining into a single system, a combination known as duo-mining [9]. This combination has proven especially useful in banking and credit card customer relationship management. Instead of being able to analyze only the structured data they collect from transactions, they can add call logs associated with customer service and further analyze customer spending patterns from the text-mining technology –

beyond simple search methods – are the key to information discovery and promise support in all areas. Companies with vast document collections sitting idle should consider investing in text mining applications that would help them analyze their documents and provide payback with the information they provide.

## Opinion Mining

OM is a recent discipline at the crossroads of information retrieval and computational linguistics which is concerned not with the topic a document is about, but with the *opinion* it expresses [21]. It is a common practice that merchants selling products on the Web ask their customers to review the products and associated services [5]. As e-commerce is becoming more and more popular, the number of customer reviews that a product receives grows rapidly. For a popular product, the number of reviews can be in hundreds or even thousands. This makes it difficult for a potential customer to read them to make a decision whether to buy the product. It also makes it difficult for the manufacturer of the product to keep track and manage customer opinions. For the manufacturer, there are additional difficulties because many merchant sites may sell the product and the manufacturer normally produces many kinds of products. OM aims to mine and to summarize all the customer reviews of a product [18]. This summarization task is different from traditional text summarization because we only mine the features of the product on which the customers have expressed their opinions and whether the opinions are positive or negative. We do not summarize the reviews by selecting a subset or rewrite some sentences of the original sentences from the reviews to capture the main points as in the classic text summarization. OM is used to answer, for example, the following kinds of questions. What is the *general opinion* on the proposed tax reform? How is popular opinion on the presidential candidates *evolving*? Which of our customers are unsatisfied? *Why*?

One of the reasons for the lack of study on opinions until recently is that there was little opinionated text available to general public before the World Wide Web. When an organization needed to find opinions of the general public about its products and services, it conducted surveys and focused groups. Now there are plentiful of product reviews on the Web which give the opinions of the existing users of the product. Finding opinion sources and monitoring them on the Web, however, can still be a formidable task because a large number of diverse sources exist on the Web and each source also contains a huge volume of information. In many cases, opinions are hidden in long forum posts and blogs. It is very difficult for a human reader to find relevant sources, extract pertinent sentences, read them, summarize them and organize them into usable forms. An automated OM and summarization system is thus needed. OM, also known as *sentiment analysis*, grew out of this need [1].

The technologies used in the OM process have the following capabilities: (1) formulation of the abstract model of OM, (2) perform sentiment classification, (3) perform feature-based OM and summarization, and (4) perform OM from comparative sentences.



The formulation of the model introduces the basic definitions, core concepts and issues, sub-problems and target objectives. From an OM application point of view, it tells practitioners what the main tasks are, their inputs and outputs, and how the resulting outputs may be used in practice [16]. Sentiment classification can be performed at two levels – document and sentence. The document-level sentiment classification, aims to find the general sentiment of the author in an opinionated text. For example, given a product review, it determines whether the reviewer is positive or negative about the product. The sentence-level sentiment classification determines whether a sentence expresses an opinion or not, and if so, whether the opinion is positive or negative.

Feature-based OM and summarization first discovers the targets on which opinions have been expressed in a sentence, and then determines whether the opinions are positive, negative or neutral. The targets are objects, and their components, attributes and features. An object can be a product, service, individual, organization, event, topic, etc. For instance, in a product review sentence, it identifies product features that have been commented on by the reviewer and determines whether the comments are positive or negative. For example, in the sentence, “The battery life of this toy-train is too short,” the comment is on “battery life” of the toy-train object and the opinion is negative. Many real-life applications require this level of detailed analysis because in order to make product improvements one needs to know what components and/or features of the product are liked and disliked by consumers and why. Such information is not found by sentiment and subjectivity classification.

Evaluation of a target object can be done mainly in two ways: direct appraisal and comparison. Direct appraisal, called *direct opinion*, gives positive or negative opinion about the object without mentioning any other similar objects. Comparison, called *comparative opinion*, means to compare the object with some other similar objects (e.g., competing products) [17]. For example, “The track quality of this toy-train is poor” expresses a direct opinion, while “The track quality of this toy-train is better than that of Toy-train-X.” expresses a comparison. Clearly, it is useful to identify such sentences, extract comparative opinions expressed in them and determine which objects are preferred by the sentence authors (in the above example, Toy-train-X is preferred with respect to the track quality).

## OPPORTUNITIES

Opinions are so important that whenever one needs to make a decision, one wants to hear others’ opinions. This is true for both individual consumers and organizations and businesses levels. The technology of OM thus has a tremendous scope for practical applications [26].

Individual consumers: If an individual wants to purchase a product, it is useful to see a summary of opinions of existing users so that he/she can make an informed decision. This is better than

reading a large number of reviews to form a mental picture of the strengths and weaknesses of the product. He/she can also compare the summaries of opinions of competing products, which is even more useful.

Organizations and businesses: OM is equally, if not even more, important to businesses and organizations. For example, it is critical for a product manufacturer to know how consumers perceive its products and those of its competitors [11]. This information is not only useful for marketing and product benchmarking but also useful for product design and product developments.

The current spread of consumer generated media such as social network websites like Twitter, blogs and discussion forums means customers can become influential like never before. But for businesses this offers an opportunity for obtaining business and marketing intelligence – for example, trend/buzz analysis, OM, and authority/influence analysis. That is an opportunity to see how customers view them, then act and benefit.

Social business intelligence system can thus be potentially developed which could possibly have one or more of the following features or capabilities. Discover what people think of a company's brand or products; monitor what is being said about a company and its products, across blogs, forums; provide discussion boards and news sites to the customers; discover the sentiment and opinions of these people; view the main influencers of a company's brand; view bloggers mood trends over days, weeks, months and years; setup alerts to email managers when bad press events occur; alert customer service for very dissatisfied customers; and gain intelligence to develop more targeted marketing, improve products and gain even more customers.

## CHALLENGES

With opportunities come challenges. OM is still a nascent topic in the information systems research and development community, it needs to go through the usual growth and maturity stages as any new technologies go through. Therefore there are many challenges to overcome.

Finding opinion sources and monitoring them on the Web is still be a formidable task because there are a large number of diverse sources, and each source may also have a huge volume of opinionated text – text with opinions or sentiments. Thus, automated opinion discovery and summarization systems are needed. OM is a challenging natural language processing or text mining problem [7]. OM takes a structured approach to exploring the problem. In non-natural language processing literature, natural language documents are regarded as unstructured data, while the data in relational databases are referred to as structured data [14]. One of the challenges for the researchers and developers therefore is converting the unstructured text into an equivalent structured text for processing. The structured approach means to turn unstructured

text to structured data, which enables traditional data management tools to be applied to slice, dice, and visualize the results in many ways. This is extremely important for applications because it allows the user to gain insights through both qualitative and quantitative analysis. It is a fast-growing research area, in which progress has been made in recent years.

Another challenge is improving the accuracy of OM results [23]. That is improving the accuracy in determining the degree to which an opinion is positive, negative or neutral for the entire content or a segment of the content – described as one of the reasons for conducting OM. Another important challenge is to develop an ability to perform a fine-grained analysis of customer opinions. OM is not simply the problem of determining whether a document, a paragraph or even a sentence expresses a positive or negative opinion. It is also about entities. Without such information, any opinion is of little practical use. So one should not only talk about OM of documents, paragraphs or sentences, but also about the entities that opinions have been expressed upon. An entity can be a product, service, person, organization, event or topic. Furthermore, in many cases, only looking at entities may not be sufficient because one may want to know opinions on components and attributes of entities [12]. Additionally, one should realize that localization is also important in terms of the text content. For example, it does not make much sense studying opinions of a document as a whole if the document talks about multiple entities...evaluate them and compare them.

The widespread use of OM is dependent on the rapid development of commercial OM products – with intelligent analytics and reporting capabilities – by the software vendors. The research literature suggests that in recent years many software vendors have started developing such products.

## **CONCLUDING REMARK**

The Web provides a public channel for consumers to express their opinions on consumer products. Opinion mining supports companies and individuals to exploit these sources of information to gain market intelligence. In this research, we attempt to conduct an in-depth investigation of the technologies, applications, opportunities, and challenges of deploying opinion mining for competitive advantage. The study is currently underway.

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# **UNDERSTANDING USER MOTIVATIONS AND USAGE PATTERNS FOR MOBILE MESSAGING TECHNOLOGIES (MMT)**

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## **ABSTRACT**

This study employs focus group interviews to investigate the user motivations and usage patterns for mobile messaging technologies (MMT), including short messaging service (SMS), mobile email (MEM), mobile instant messaging (MIM), and multimedia messaging service (MMS). A number of user motivations and patterns of social interactions emerged from MMT usage. This study contributes to our understanding of the complex nature of MMT usage that is influenced by a variety of factors. It provides insights on the way how MMT fits into users' everyday lives, supports existing and creates new communication practices for social interactions, and suggests directions for a better design of mobile messaging services.

## **INTRODUCTION**

Mobile messaging technologies (MMT) are evolving rapidly to provide multiple mobile communication services and applications, such as short messaging service (SMS), mobile email (MEM), mobile instant messaging (MIM), and multimedia messaging service (MMS). With an increasing number of MMT users, a new form of ubiquitous communication is emerging. It is projected that in 2009 U. S. subscribers will send over 126 billion messages via their mobile devices, generating \$8.6 billion revenue. The rapid diffusion of MMT worldwide has established a need to understand why MMT has become popular and how people use MMT in their daily lives. Nowadays, people are often presented with a wide variety of choices of communication media. In addition to MMT, there are traditional telephony, stationary email, stationary instant messaging, and mobile voice communication. Different communications media offer different possibilities and experiences for people. A good understanding of why and how people use MMT for various purposes can advance our knowledge of user choice and use of MMT over other communication media as well as different patterns of social interactions emerging from the use of MMT.

The purpose of this research is to identify the motivations underlying the use of MMT and the corresponding usage patterns of MMT. The findings of this study will not only inform a better design of mobile messaging services but also provide insights on the way how MMT fits into users' everyday lives, supports existing and creates new communication practices for social interactions.

## **LITERATURE REVIEW**

The uses and gratification theory [1] has been widely applied to study the motivations underlying media consumption in an everyday context [2], such as conventional telephone [3], pager [4], email [5], and cell phone [6]. It focuses on the individual use and choice of communication media motivated by the desire to satisfy a wide variety of psychological needs. The theory assumes that media users are active participants in their media choice and use [1]. They are aware of their needs and select appropriate media to gratify their needs [1]. Much of the uses and gratifications research has been focusing on identifying the gratifications satisfied by the use of certain media [7, 8]. Flaherty, Pearce and Rubin (1998) identified six primary communication motives or needs: inclusion, affection, control, pleasure, relaxation and escape [9]. The uses and gratifications research has provided support for both intrinsic and instrumental motivations underlying media usage. As such, the motivations underlying conventional telephone usage are functional motive, i.e., information seeking, making appointments, etc., and relational motive, i.e., chatting, keeping contacts with family and friends, etc. [10]. Cell phone usage is motivated by mobility, immediacy, instrumentality, and affection/sociability [6].

While the uses and gratification research studies the gratifications sought by media users, the media adoption and choice research examines the factors influence users' adoption and use of communication media. Studies [11-16] have shown that media choice and general patterns of media use are determined by communication media attributes (such as interactivity, channel capacity and adaptiveness), social influence (such as peer influence), and situational factors (such as task characteristics, communication goals, and message attributes). A number of studies have investigated the use of email, instant messaging, and short messaging services. Zack found that email is an efficient task-oriented communication medium within an established context [17]. Compared to email, instant messaging and short messaging services afford higher interactivity and communicate shorter messages [13]. They are used for coordinating availability, maintaining social connections, switching media, and retaining context [18]. Users tend to combine short messaging services with other forms of media and other messaging services [17-19]. For example, short messaging service is used to complement face-to-face or telephone communication.

## **RESEARCH METHOD**

This research was exploratory and therefore used a qualitative method. Three focus group interview sessions were conducted, each of which consists of a number of open-ended questions, asking the participants about their motivations for and experiences of using MMT (the focus group interview protocol is presented on page 3). All focus group respondents were users of MMT, including SMS, MEM, MIM, and MMS.

The group interviews were recorded, transcribed and analyzed using Glaser and Strauss's grounded theory approach [20], which facilitates the emergence of theoretical themes. The contents of all three interview transcripts were analyzed and categorized, line by line, into different motivations and usage patterns for MMT.

## RESULTS

### Media Attributes

Short Messaging Service (SMS) is commonly referred to as “text messaging”. It is a service for sending and receiving short messages of up to 160 characters using mobile devices. Mobile Instant Messaging (MIM) is a presence enabled mobile messaging service that communicates messages as well as presence information. The presence information allows users to declare their availability or status information to others. Both SMS and MIM have emerged as the media for sending short, conversational messages. Mobile Email (MEM) allows users to access email services and read, delete, and respond to their emails using mobile devices. MIM is a synchronous form of communication, and MEM is an asynchronous communication medium with slow feedbacks. While SMS is also asynchronous, it lends itself better than MEM to ongoing communication because SMS messages are usually received and answered rather soon. Sometimes the dividing line between MIM and SMS is not clear. Therefore, SMS is semi-synchronous, located between the synchronous MIM and the asynchronous MEM. While SMS messages are transmitted as stand-alone text only messages, however MIM messages are often embedded in larger discourse contexts (e.g., status information, profiles, colors, fonts, and expressions). An MIM message comprises an entire conversation as it unfolds, while an SMS message only includes one message of a conversation at a time. Therefore, it’s a lot easier to keep track of a conversation using MIM than SMS. Multimedia Messaging Service (MMS) enables mobile users to send and receive multimedia messages (such as images, video, etc.). Like SMS and MEM, MMS is also an asynchronous communication medium, however, MMS supports many more forms of information cues (video, audio, image) than text-based messaging services, e.g., SMS, MEM and MIM.

### Communication/Task Characteristics

In comparison to MEM, SMS and MIM are more personal and conversation-like. The participants stated that they use SMS and MIM to chat with people they have close personal relationships with, and use MEM for non-personal communication with colleagues and superiors. They all indicated that MEM is more official and formal than SMS and MIM, which are conversational and not appropriate for communication with superiors. Therefore, the use of MEM is more related to instrumental than to interpersonal gratifications when compared to SMS and MIM. Since SMS is semi-synchronous in that the prompt attention of the communication partner is expected, SMS is often used to deal with immediate issues, such as coordination, whereas MEM is used to deal with issues that are less time sensitive. SMS is also seen as suitable for conveying short, straightforward messages under situations involving unidirectional communication and information conveyance. Since MIM is high in synchronicity, MIM communication tends to be bidirectional which occurs when both communication parties are available. In the case of SMS, due to the absence of message receiver’s availability status, SMS message sender usually initiates a bidirectional conversation by asking if the receiver is available for communication.

While both SMS and MIM encompass instrumental communications, such as transmitting useful information and coordinating the time and place of meetings, most SMS and IM communications



have a social tone. Most participants reported that expressive socio-emotional communications, e. g. greetings, congratulations, and jokes, are especially important in their daily use of SMS and MIM. They consider SMS and MIM communications as enjoyable and pleasant because these two media are high in connectedness and sociability. They noted that SMS and MIM are particularly important in maintaining contact with a wide social network. SMS and MIM allow them to maintain social bonds without committing much time and energy compared to other communication media (e.g., phone call).

The participants also indicated that they use SMS to avoid a spoken conversation and have private communication without interrupting any ongoing events, such as attending meetings or classes. SMS is so non-intrusive that it greatly enhances highly informal contacts that would not take place otherwise, such as by phone calls. SMS is frequently employed to send out messages (e.g., goodnight kiss) that do not need replies. The participants stated that they would never have called to deliver the same message. The frequent communication of such brief, informal SMS messages significantly improves the social closeness between the communicators.

MMS supports the transmission of images and videos, which provide a more natural interface for social interaction than text-based communication, such as MEM, SMS, and MIM. With MMS, users can communicate things that are beyond text. MMS has the ability to immediately send a photograph or a video instead of trying to describe the situation using text. According to the participants, MMS are not typically used as videophone, such as showing talking heads. More often, the MMS-supported conversation is about what is in the images or videos. The participants use MMS to communicate and share experiences with others. MMS provides a way to document the situation at a particular time and place. The use of videos and images can help the users to visualize specific details of a situation, an event or an object. This provides a realistic sense of what a particular experience is. Sometimes the participants also use MMS to document a situation as a type of evidence or reference for later processing rather than sharing.

### **Mobility and Usage Contexts**

Although SMSs can be sent from a stationary computer, the participants claimed that they only send and receive SMS messages from their mobile devices. MEM, however, is often utilized as the supplement of stationary Email. The participants read and send emails using both mobile devices and stationary computers. They noted that it is important that all the email messages be synchronized on the mobile service and stationary computer, including folders and email status (read / unread). Similar to MEM, the purpose of MIM is to transpose the desktop messaging experience to the usage scenario of being on the move. Thus MIM is primarily used as supplementary to stationary Internet IM. The participants employ MIM to interwork with stationary Internet IM systems, such as MSN, Yahoo! and Google messengers. Unlike SMS messages that are mostly sent and received from mobile devices anytime anywhere (e.g., in the office, at home, in class, on the move, etc.), MIM and MEM are used only when the participants are on the move, where the access to a physically tethered or semi-tethered computer is not available.

The participants reported that they utilize MEM, SMS and MIM as a way to fill “dead time”, e.g., when traveling or waiting. Furthermore, it was also pointed out that the non-intrusive nature

of MMT enables the mobile messaging interactions to be woven into participants' other ongoing activities and allows them to carry out various tasks at the same time. The multi-tasking mobile messaging communications thus lead to loose conversions wherein turn takings are not tightly intertwined nevertheless near-constant contacts are still maintained.

## CONCLUSION

Nowadays people use a range of fragmented MMT services to communicate. They use MEM for exchanging data and formal communications, use SMS and MIM for chatting and brief informal communications, and use MMS primarily for sending images/videos and sharing experiences with each other. This study provides insights on the different usage patterns of MMT driven by various user motivations, media attributes, characteristics of communication tasks, and usage contexts. Analyzing the patterns of MMT usage is crucial to understand how the use of MMT brings out changes in the users' self-expression forms, communication practices, and social relations. The results of this study will not only benefit future research efforts in investigating the consequences/outcomes of MMT usage, but also suggest directions for a better design of mobile messaging services that encourage and support fruitful usage of mobile media.

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**Modeling Consumer Demand:  
A Leisure and Recreational Industry Case Study**

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# **Modeling Consumer Demand: A Leisure and Recreational Industry Case Study**

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## **Abstract**

*This paper is Part 1 of a two part case series about the discrete event simulation of a service network in a recreational industry setting. Part 2 takes the results of the forecasting model discussed in this paper as demand input for a discrete event simulation of the skiing operations of Vail Resorts located in Colorado, United States. This paper develops a model for forecasting skier days for each day of a ski season. Skier days is the most important metric within the ski industry and capacity, budgeting, and labor decisions are all highly influenced by this metric. Skier day data over a five year period is utilized in developing both a stepwise regression forecasting model and a neural network prediction model. Dependent variable selection and coding is discussed in detail. The neural network modeling technique provides significantly better forecasting results over the standard linear regression models.*

*Keywords: ski resort, demand forecasting, stepwise multiple regression, neural networks*

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## **Introduction**

“My God, we’ve climbed all the way to heaven,” said Pete Seibert to Earl Eaton on a climb to the top of an unnamed mountain, March 19, 1957. These words are immortalized in the Ski Hall of Fame, because on that clear blue sunny day, the vision for Vail Mountain Resort ([www.snow.com](http://www.snow.com)) was born. Seibert and Eaton, on that causal climb, realized the potential for a world class ski area because of the ideal terrain and the predictable snowfall. In 1961, Seibert and Eaton were successful in acquiring land leases from the United States Forrest Service. The following year, the ambitious team along with several other ski enthusiasts, under the partnership name, Vail Associates, opened Vail Resorts in a long remote valley, at the feet of the newly named Vail Mountain. The resort grew in size and reputation over the years, because of the consistent snowfall and the company’s adamant adherence to quality for the customer. However, between 1976 and 1996, corporate management and ownership changed three times, consisting of various mergers and acquisitions. In 1996, due to these management changes and resort acquisitions, the board assessed and determined that Vail Associates had neglected its strategic vision, and hired Adam Aron, a veteran of the travel industry, as the new CEO.

Aron immediately implemented an aggressive management agenda, which included taking the

company public in January 1997, as Vail Resorts, Inc. (NYSE: MTN). Aron realized that the recreational ski industry was changing because of a number of economic and demographic factors and that revenue diversification was of utmost importance for Vail Resort's long term competitive viability. These factors included, flat skier day growth due to the aging population, significant industry consolidation, and substantial capital investments in on mountain operations, base support, and accommodations by large competitors. To communicate the new vision and agenda, Aron said, "at Vail Resorts, we are focused on expanding and enhancing our core ski operations while increasing the scope, diversity and quality of the activities and services we offer our guest, skiers and nonskiers, throughout the year" (ref...). This new vision translated into four strategic objectives:

- Continue a focus on the passion for quality
- Create new experiences with a wider customer appeal
- Leverage Vail's superior market position and strong market share
- Take advantage of industry consolidation

To support these strategic initiatives, Aron and the management team stated and pursued two operational goals: acquire and expand, and vertically integrate. Vail Resorts purchased three major resorts all within a one hour drive from Vail Mountain, moved aggressively into lodging management and real estate development, and began marketing the resort portfolio with all season destination resort themes. By the turn of the millennium, Vail Resorts held one of the highest reputations in the ski resort industry with SKI Magazine consistently ranking Vail Resorts, in their well respected annual survey of North American ski resorts, as number one or number two (ref...). Vail Resorts over the years had cultivated an image of high end, upscale and high status, of which they are proud. However, the resort is also known as "the land of the rich" which is, unfortunately, supported by fact that the resort has the most expensive day lift ticket in North America. By 2006, Vail Resort had a maturing business model and day to day operations were grouped into three segments: mountain, lodging, and real estate representing approximately 65%, 25%, and 10% respectively. That same year, Adam Aron announced that "he felt that he achieved what he set out to do for Vail and it was time to step aside" and Robert Kratz was appointed the new CEO.

Within his first year of tenure, Kratz moved the corporate office from its venerable location of Avon, Colorado to Bloomfield, a nearby suburb of Denver, Colorado. The move, while quite controversial at the time, gave Vail Resorts more corporate visibility and access to a much larger talent pool for financial, information technology, and human resources skill sets. Vail has won numerous industry awards for ecommerce and technology innovation. Being an early adopted by buying SNOW.COM in 1995 and cultivating a culture of innovation with Vail Labs, are examples of how Vail Resorts uses technology for competitive advantages, according to CIO, Robert Urwiler.

## **The Industry**

The U.S. ski resort industry has seen broad contraction over the last twenty years; having as many as 725 in 1985 with only approximately 475 today (ref...). Staying competitive in the mountain resort industry requires innovation, well financed strategic projects, world class all-season facilities, and a strong long term vision for the future. Short sighted quick profit fixes in this industry, have not sustained customer loyalty or gained new visitors. The skiing industry is a very capital intensive industry and growth potential is limited by land and climate. Rising cost and the motivation to increase facility occupancy and achieve economies of scale, are forcing ski areas to become year round resorts (ref...). Destination resorts have made a successful move into twelve month recreation while most day resorts tend to remain seasonal. As previously indicated, although there are approximately 475 ski resorts in the United States, the industry is highly concentrated with ten percent of the resorts controlling over fifty percent of revenues (ref...). Some limited research has been conducted that correlates the decrease in the number of U.S. ski resorts to the increasing age of the U.S. population (ref..). Skier days, an industry metric that represents one skier purchasing one lift ticket, growth has been flat since the early 1990s when there was a short growth surge associated with snowboarding (ref...). In an effort to attract new skiers and keep the valued skiers that they have, destination resorts made exceptionally large capital investments during the later part of the 1990s and well into the new decade, in on mountain infrastructure such as high capacity lift systems and snow making systems, upscale lodging and restaurants, and real estate developments. Unfortunately, some of these investments, notably specialty real estate developments, have placed enormous cash flow pressures on all ski resorts, whether a day resort or destination resort.

Ski resorts are classified as being a destination resort or a “windshield” resort. As recent as two years ago, the industry as a whole referred to the four largest ski resorts as the “Big Four.” These destination resorts were Vail Resorts, American Skiing Company, Intrawest Corporation, and Booth Creek, Inc. All these resorts owned a portfolio of mountain and summer resorts, all with familiar names, such as Killington, Steamboat, Vail Mountain, and Whistler Blackcomb. In 2007, the industry consolidation trend continued with two rather surprising events. The American Skiing Company liquidated all its assets, including the sale all ski properties and dissolved its charter (ref...). In addition, the Fortress Investment Group (NYSE: FIG) took Intrawest Corporation, the largest ski resort by revenue, private. Intrawest Corporation was known as “a real estate development company that happened to own a few ski resorts,” however, the current severe economic downturn and the resulting stagnation of resort real estate sales took its toll on Intrawest’s staggering debt load (ref...).

“Windshield” or day resorts tend to be smaller resorts within driving distance of major metropolitan areas, such as Snowbird and Alta near Salt Lake City, Utah and Monarch Resort and Purgatory Resort near Durango, Colorado. The majority of day resorts do offer limited accommodations and après ski activities, however the majority of their revenues come from a

group of customers known within the ski industry as “park and sliders.” Lift tickets are not considered a high gross margin sale, while dining, retail, specialty activities, and lodging all have higher margins. Day resorts certainly have realized that revenue diversification is just as important to them as it is to destination resorts. This need for a broader revenue mix, of course, places more competitive pressure on day resorts to enhance services, expand terrain, upgrade lifts, and add specialty activities, all of which require large capital investments. All of these economic and competitive pressures are directly related with the continuing consolidation of the ski industry (re...).

As an assessment and summary of the ski resort industry, an analysis using Porter’s Five Forces follows. The industry rivalry is high, due to significant consolidation over the last ten years, which has resulted with approximately fifty percent of industry revenue going to less than ten percent of the ski resorts. Although day resorts have overall, a lower fixed cost structure as compared to destination resorts; the destination resorts are better financed and enjoy the cash flow benefits of economies of scale (ref...). With substantial industry consolidation, supplier power is essentially nonexistent. The large destination resorts and even the large day resorts have the majority of the negotiating power among their vendors. The ski consumers of the millennium are more educated, have a higher occupational status, higher incomes and are more likely to be global travelers (ref...). So, these visitors are more discerning about the price to value propositions available from resorts and demand quality service, all season experiences, require access to current information technologies, all with a relaxed and discrete atmosphere. Without question, customer power is very high, and this observation is supported by the existence of many competitive substitutes. There are numerous premiere vacation oriented resorts such as Disney World and Sandals and even cruise line represent a marginal substitute all competing for the consumer’s vacation budget. The skiing industry is very capital intensive, is controlled by high fixed cost, and is constrained by land and climate. All of these factors per se make the industry an exclusive economic endeavor, sustain barriers and prevent entry. From an incumbents perspective and a potential entrant, as well, an industry assessment of neutral seem appropriate. From a classic business strategy viewpoint, the industry is “stuck in the middle” which is, generally, the most challenging industry position for companies to hold (ref...). Possible entrants should think long and have seemingly endless capital reserves, before attempting to build or buy a ski resort. The “stuck in the middle” dilemma quite easily forces the incumbents to have an all or nothing operational focus.

### **The Problem of Skier Days**

The most important metric within the ski resort industry is referred to as skier days. This term is used to “denote one visit by a guest, be they a skier, snowboarder, telemark skier, ski-biker, or ski boarder, to a ski and/or snowboard resort” and is “a way to state attendance figures over the course of a ski and snowboard season” (ref...) The figure is essentially a measure of daily attendance at a specific resort for a specific day by one unique skier. Resort management,



essentially, develops all operational plans, capacity schedules and financial decisions based on the skier day metric. The use of this iconic metric is similar to how the airline industry relies on revenue passenger miles and how the hospital sector depends on patient beds. A key annual management decision is the forecasting next season skier days.

The author proposes a novel approach to forecasting aggregate skier days over a complete season by utilizing a feed forward neural network and comparing the results to a step wise multiple regression forecasting model. The remainder of this paper consists of three parts, a section detailing modeling the independent and dependent variables, a section discussing a step wise regression model and the resulting root mean squared error and the final section illustrates the development and implementation of a neural network and the resulting root mean squared error.

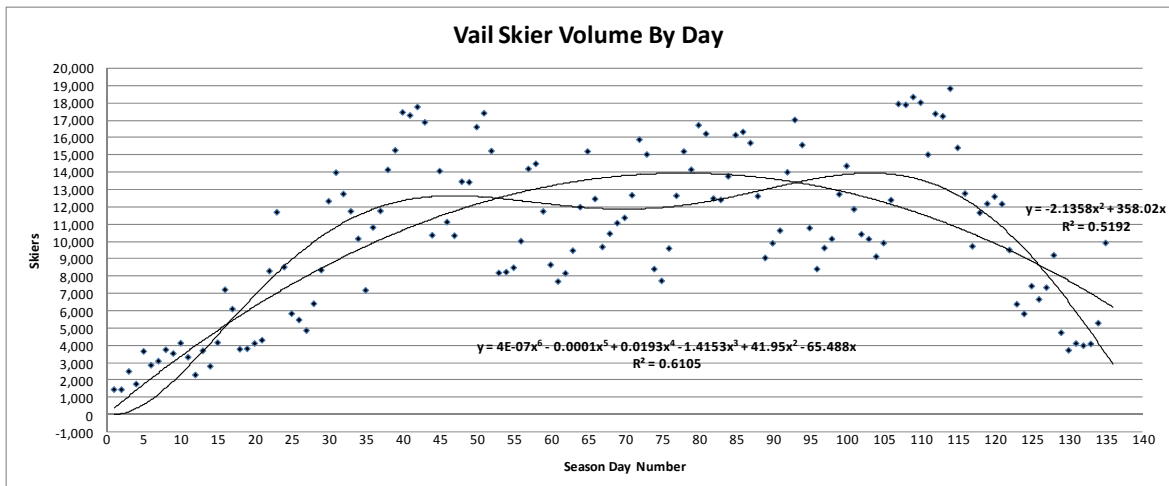
### **Modeling the Variables**

The following standard modeling framework was employed for this research problem (ref...).

- Identify the key dependent variable
- Identify a set of candidate independent or predictor variables
- Collect and organize observational data
- Construct several hypothesized models
- Perform statistical analysis
- Determine if models are statistically sound
- Select a model for application

There is very limited research on skier day forecasting (ref...). The independent variable set is based primarily on the intuition and skiing experience of the author due to the limited availability of research or corporate models. Historically, most ski resorts guarded their skier day metrics and any related forecasting models. Over the last few years, industry organizations such as the National Ski Areas Association ([www.nsaa.org/nsaa/home](http://www.nsaa.org/nsaa/home)) and Colorado Ski Country ([www.coloradoski.com](http://www.coloradoski.com)) have convinced their members to submit for publication, their annual skier day aggregate metric, i.e., their total skier attendance for the season. This transparency afforded the skiing community is seen as a long term positive benefit to resort owners. However, the Ski Utah industry association only publishes total skier days for all ski resorts in Utah.

In this specific case, Vail Resorts provided a data set that consists of the total attendance for each day of the season over five seasons. A stepwise regression methodology, based on the standard backward elimination algorithm, will be utilized to determine the best set of independent variables. For the stepwise regression analysis, the data will be organized into two sets: the first set consists of the complete previous year's data and the second set consists of 150 random samples from the five year data set. This set of independent variables will then be



**Exhibit 1:** Clearly discernable seasons at Vail Resorts.

compared to the optimal set of independent variables determined by a feed forward neural network. The overall comparison criterion is root mean squared error. The preliminary independent variable set is as follows:

$X_1$  = a binary independent variable for Day Type, 1 = weekend and 0 = weekday. Traditionally weekends are busier for most recreational activities. Resort pricing is demand driven and is higher for weekends.

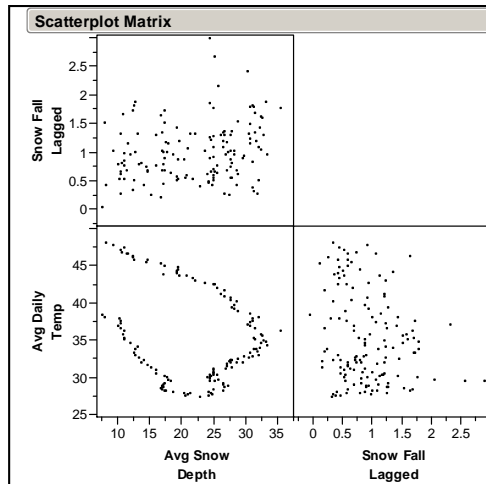
$X_2$  = a binary independent variable for Holidays, 1 = a major holiday and 0 = otherwise. Holidays are typically much busier as compared to other days of the season. Obviously, schools are out of session and more people are not working. Resort pricing is demand driven and is higher on holidays.

$X_3$  = a binary independent variable for Season Type Early, 1 = early season and 0 = otherwise. Typically, resorts offer discounts for early and late seasons in attempt to stimulate demand.

$X_4$  = a binary independent variable for Season Type Regular, 1= regular season and 0 = otherwise. Most resorts have their highest pricing options during regular season. The definition of the season type is different per resort.

$X_5$  = a binary independent variable for Season Type Middle, 1= middle season, 0 = otherwise. It is common for Colorado ski resorts to see a “slower” mid-season demand. Exhibit 1 provides excellent evidence to support the varying skier demand throughout one ski season. The traditional marketing defined seasons of peak, shoulder and saddle are clearly present in the chart.

The major of Colorado ski resorts experience a “spring break” increase in skier demand. The variable is represented by the absence of all the proceeding season types, i.e., 0,0,0. Thus, N



**Exhibit 2:** Scatterplot of the continuous variables.

binary variables can be represented by N-1 binary variables. This is important because in most regression models, algorithm actually penalizes the use of more variables.

$X_6$  = a continuous independent variable for average snow depth for a specific resort. It is common for resorts to post their current snow depth. This metric is questionable at best, depending on the measurement practice. For each day of the season, it is often the practice for ski resorts to measure the snow pack from one protected location. A few resorts gather several measurements and report an average. Intuitively, the more snow the better.

$X_7$  = a continuous independent variable for one day lagged snowfall. It has been the author's experience that "when it snows, you go." Thus, it follows that a large snowfall would stimulate demand for the following day.

$X_8$  = a continuous independent variable for average daily temperature. There are a number of skiing personas, such as social skier, family skier, and adventure skier. Each one of these personas have preferences as to snow conditions, temperature and crowds.

$Y$  = an integer dependent variable for the actual skier day metric for a specific day of the season. This variable represents the predicted or forecasted skier days based on the following model:

## Stepwise Regression

*"True genius resides in the capacity for evaluation of uncertain, conflicting and hazardous information."*

-Winston Churchill

The following multiple regression model is a preliminary model that will be analyzed by stepwise regression methods, utilizing both the backward and the forward algorithm:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + (\beta_9 X_6 * X_7) + (\beta_{10} X_6 * X_8) + (\beta_{11} X_7 * X_8)$$

Note the hypothesized interaction between average snow depth and one day lagged snowfall in the preliminary model. Also, note the possible interaction between average snow depth and average daily temperature. It is intuitive that if there is a significant snowfall, the following day skier attendance should be higher. However, there are some underlying issues that weaken this relationship, specifically rather the resort is a day resort or a destination resort. Day resorts may see a sudden increase in skiers on a weekend if it turns out to be a blue ski day with 2 feet of new powder, but the issue with a destination resort is the skiers may not be able to actually drive to the resort.

A first step in a multiple regression analysis is to verify that the preliminary model does not display any collinearity problems among the possible set of independent variables. A simple way to assess a collinearity problem is to create a scatter plot matrix that illustrates a pair wise comparison of each independent variable. If present, collinearity will be appears as linear relationships between pairs of independent variables. Exhibit 2 shows the relationships between the three continuous variables,  $X_6$ ,  $X_7$ , and  $X_8$ . The binary variables do not lend themselves to realistic analysis for collinearity in this specific setting. The average snow depth,  $X_6$ , and Snowfall lagged,  $X_7$ , do not show any degree of linearity and the relationship appears to be quite random. The average day temperature,  $X_8$ , and snow fall lagged,  $X_7$ , do not exhibit any linearity as well. However, average daily temperature,  $X_8$ , and average snow depth,  $X_6$ , do display a unique nonlinear relationship that may pose problems further into the analysis. So, from this general test, the independent variable set does not reveal any significant collinearity. The key reason why collinearity among the independent variables is a problem and invalidates the model, is because the overall F test is usually highly significant, but none of the individual t test for the independent variables will be significant and the predicative value of any one specific independent variable is difficult at best to determine (ref...).

The backward elimination algorithm for stepwise regression begins with fitting the multiple regression model with all the independent variables and interactions. The process “steps” through the analysis by eliminating one candidate variable at a time by removing the least statically significant variable during the iteration. A companion stepwise regression method called the forward elimination algorithm that iterates thorough the candidate variables in a completely opposite process.

$$BKWD: X_9 = \beta_1 X_1 + \beta_3 X_3 + \beta_6 X_6 + \beta_8 X_8 + (\beta_{10} X_6 * X_8)$$

$$FRWD: X_9 = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + (\beta_{10} X_6 * X_8) + (\beta_{11} X_7 * X_8)$$

Method	MSE	RMSE	F <sub>test</sub>	R <sup>2</sup> <sub>adj</sub>
Bkwd	8265365.4	2874.95	37.528	.5626
Frwd	8134276.8	2852.06	21.875	.5695

Exhibit 3: Stepwise regression results.

The majority of statistical packages allow the user to run both test and compare the results. For

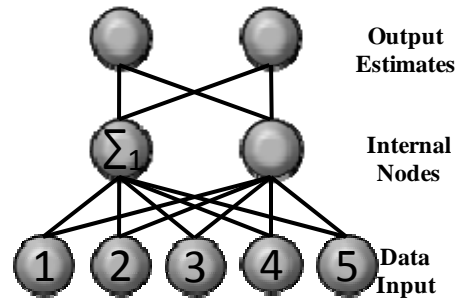


Exhibit 4: A basic neural network.

Vail Resorts the  $R^2_{adj}$  for both methods are almost identical as seen in Exhibit 3, however, technically the forward elimination method produced a higher  $R^2_{adj}$ . Note the different independent variable set that result from each method. Theory aside, and leaning to application, a smaller model with more intuitive variables has a better chance of actually being implemented in the “real world.” Appendix 1 provides more details on coefficients, t-tests, and step history.

From a social science perspective, an  $R^2_{adj}$  of over .30 is very significant (ref...) and in the Vail Resorts case, the resulting  $R^2_{adj}$  are exceptionally high and the forecasting model should be incorporated into their capacity planning process and the discrete simulation model.

## A Neural Network Approach

*“I’m not interested in developing a powerful brain. All I’m after is just a mediocre brain.”*

- Alan M. Turing

Essentially a neural network is an artificial intelligent tool with a storied history used for classification or prediction problems. The algorithm has been called an all purpose mapping function, not unlike linear regression, but excels with highly nonlinear problems and environments (ref...). The connection with artificial intelligence applications, is that given a set of input variables, the neural network is able to “learn” through many iterations of trial and error, how to generalize and map to a set of output variables. An artificial neural network, a more complete name, consist of nodes that are interconnects by weighted links as shown in Exhibit 4. The mathematical model mimics the functions of biological neurons, synapses and neurotransmitters. In a simplistic manner, data is “fired” from the neuron along the synapse path with a degree of intensity produced by the neurotransmitter. The fascinating thing is that an inter-connected cluster of simple artificial nodes can respond to input, with varying intensities of neurotransmission and approximate complex and nonlinear functions (ref...). The network is able to build a more complicated multidimensional curve, because each neuron has an S shaped or sigmoidal neurotransmission function embedded in it. The neuron sums all the data transmitted to it and outputs a value that is itself transmitted to another neuron. The S shaped transmission function allows each neuron to act like a mini nonlinear function that models a small piece to the total problem and then aggregates as shown in Nodes 1-5 and Summation Node 1 in Exhibit 4:

$$\text{Output Estimates}_1 = f(\text{sum})$$

while:

$$\text{Sum} = (\text{weight}_1 * \text{input}_1 + \text{weight}_2 * \text{input}_2 + \text{weight}_3 * \text{input}_3 + \text{weight}_4 * \text{input}_4 + \text{weight}_5 * \text{input}_5)$$

What is interesting is that the above summation function looks very similar to the classic ordinary least squares regression function less a Y intercept.

Neural networks have high accuracy when designed correctly, have fast computational speed once trained (ref...), and have an intuitive ease of use when implemented with superior software packages or Excel Add-ins. Neural networks are not constrained by linearity assumption or concerns about variable multicollinearity. In addition, due to their interconnected design, neural networks can model all possible variable interactions (ref...). While neural networks have been proven a powerful predictive tool in numerous business applications, as is the stepwise regression analysis discussed in the previous section, artificial neural networks do have several limitations that discourage their acceptance and implementation. One dimension that has historically been a disadvantage, at least from the practitioner's perspective, is low explainability, meaning the modeler does not necessarily know actually how the predictions are derived (ref...). One additional disadvantage limits the acceptance of neural networks is the need for large non-sparse data sets (ref...).

The preliminary network model consists of 8 input nodes that represent the same independent variables as described in the modeling the variable section. The dependent variable 9 represents the output node for skier day predications. The Tiberius Neural Network software application allows the modeler to determine how many hidden nodes to utilize within the model. The neural network was trained with three different hidden layer configurations: N-1 or 7, 2N-1 or thirteen, and 3. Recall that N binary variables can be modeled with N-1 actual model variables. The application has very intuitive interface and most tuning parameters were left at the defaults. Ninety percent of the data was partitioned into a training set and the remaining ten percent was held out for testing and verification. One nice feature is when the network has completed training, VBA code can be exported and embedded into an Excel spreadsheet.

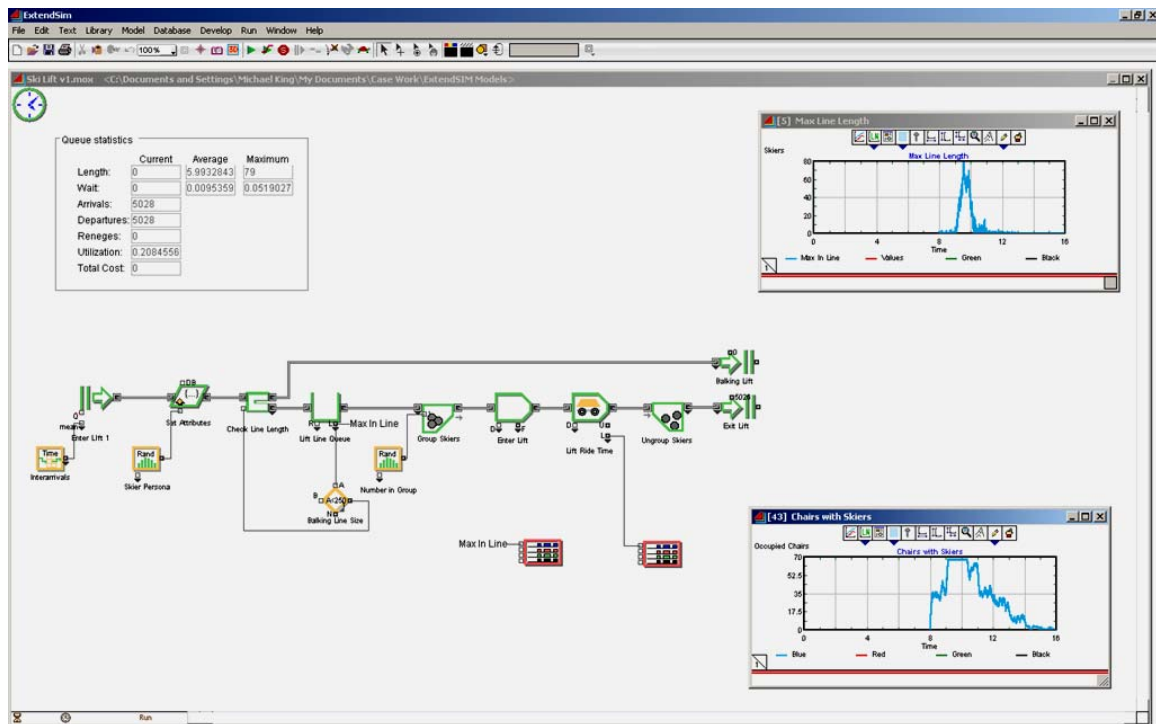
<b>Network Model</b>	<b>Partition</b>	<b>RMSE</b>	<b>R<sup>2</sup></b>
<b>7 Hidden Nodes</b>	<b>Train</b>	<b>2243.52</b>	<b>.752</b>
	<b>Test</b>	<b>2095.51</b>	<b>.806</b>
<b>13 Hidden Nodes</b>	<b>Train</b>	<b>2173.46</b>	<b>.773</b>
	<b>Test</b>	<b>2309.02</b>	<b>.742</b>
<b>3 Hidden Nodes</b>	<b>Train</b>	<b>2265.77</b>	<b>.750</b>
	<b>Test</b>	<b>2108.24</b>	<b>.789</b>

Exhibit 5: Neural network analysis.

## Conclusions

As stated, the results from these demand modeling approaches are inputs to a more complex discrete event simulation of a service network in a recreational industry setting. A complete ski resort is modeled and the operational efficiency of the lift network is analyzed using a full factorial experimental design containing numerous operational hypotheses.

The following exhibit illustrates the preliminary design on one ski lift and the resulting performance metrics for one day. Many more lifts will be added to the model in a hierarchical manner to hide the specific details of each lift.



**The Impact of Expectations on XBRL Education:  
An Expectation-Confirmation Perspective**

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## **Introduction**

eXtensible Business Reporting Language (XBRL) is an XML-based, global specification for electronically communicating financial data. XBRL uses a standardized set of tags to consistently identify data in financial statements. The U.S. Securities and Exchange Commission (SEC) is a strong proponent of XBRL and requires public reporting companies to file financial statement information in the XBRL format. According to the SEC, the XBRL filing rules are intended to make financial information easier for investors to analyze (through ease of comparability), as well as having the potential to increase the speed, accuracy, and usability of financial statements (SEC, 2009).

Although the benefits of XBRL have been extolled by the SEC a possible adoption problem with XBRL is that the initial users of XBRL (e.g. those responsible for creating XBRL versions of financial statements) may have difficulties understanding and assessing the benefits of XBRL, especially in that the primary benefits of increasing the accuracy and usability of financial statements are targeted at a different user group (i.e. investors). Accounting professionals, as well as accounting students, are now expected to produce financial statements that incorporate XBRL and tagged data. Therefore, a problem in educating this audience of emerging accounting professionals is the potential existence of an “expectations gap” regarding the technology (XBRL) and its benefits in industry.

It is within this “expectations gap” that we test a model of user satisfaction and continuance in the context of technology training and education. Specifically, we ask the research question, “Does the confirmation or disconfirmation of expectations surrounding XBRL affect the student’s satisfaction with XBRL?” In addition, we ask, “Does this satisfaction drive the student’s intention to continue using this technology in the future?”

These two research questions are analyzed through the development of a model based on expectation-confirmation theory (ECT) (Oliver 1980). Expectation-confirmation theory recognizes the importance of expectations in forming and shaping user satisfaction. Leveraging ECT, our study tests the impact of initial XBRL expectations on perceived performance and expectations confirmation. The research model is tested through a longitudinal survey at two points in time, with time one occurring before a user’s formal exposure to XBRL and time two occurring after XBRL training and usage.

Overall, this investigation holds particular relevance with education and training professionals. It highlights the importance of managing the expectations gap with new technology in order to achieve satisfaction and continued volitional education in that area.

This paper is organized as follows. First, we describe the expectation-confirmation theory, which forms the theoretical foundation of our research model. Second, we describe the research methodology used to empirically test the model. Third, we present the results of the data analysis. Finally, we discuss the results and limitations of the study and conclude with a summary of the study and its contributions.

## **Theoretical Background**

It is a well-known adage that the key to satisfying customers is to exceed the customers’ expectations. The construct of expectations and the importance of appropriately setting those expectations have been used in the marketing literature to model consumer satisfaction. One particular theory that has been used to model the relationship among expectations, performance, and satisfaction is expectation-confirmation theory (ECT). ECT originates from the marketing literature and has been used to study consumer behavior, especially repurchase intentions (e.g. Oliver 1980; Anderson and Sullivan 1993). Expectations create a frame of reference from which a consumer can make a comparative decision or judgment (Oliver 1980). ECT is a process-based model, originally developed in the context of consumer repurchase intention. ECT is described as follows (Oliver 1980). First, consumers form an initial expectation of a product prior to purchasing the product. Second, the consumer uses the product and forms perceptions about the product’s performance. Third, the consumer compares the original

expectation (pre-usage) with the perceived expectation (post-usage) and determines the extent to which the initial expectation is confirmed. Fourth, the consumer forms a level of satisfaction based on the confirmation or disconfirmation of their expectations. Finally, if satisfied, the consumer forms a level of repurchase intention. The key constructs of ECT are illustrated in Figure 1.

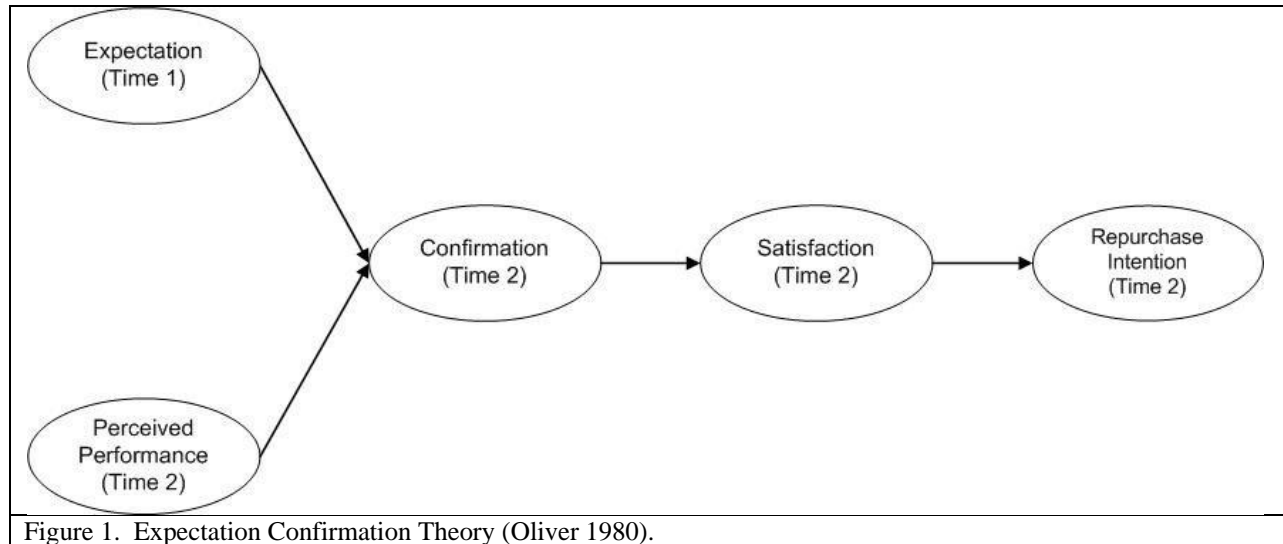


Figure 1 illustrates the temporal nature of the model. At time 1, initial expectations are formed about the product or service (in our case, XBRL). Then, after using the technology (time 2), the perceived performance of the technology is established by the individual in relation to the initial expectations to determine a confirmation or disconfirmation of his/her expectations. Ultimately, this confirmation / disconfirmation is then theorized to impact satisfaction and repurchase intention.

ECT has most commonly been applied to repurchase intentions of consumer goods and services. For example, ECT has been used to predict automobile repurchase (Oliver 1993) and camcorder repurchase (Spreng et al. 1996). In the technology area, ECT has been used to investigate the role of expectations in a large-scale VoIP solution (Nevo and Wade 2007). In the context of IS continuance, the repurchase intention construct from ECT represents an intention to continuing using an IS (Bhattacharjee 2001). With XBRL, much of the usage is mandatory in that its use is dictated by a regulatory agency, i.e. the SEC. However, repurchase intention in a training or education context can represent the intention of a person to continue to pursue knowledge or training in that area. Therefore, the research question of interest becomes: How can we influence students to continue improving their knowledge and skills in a certain area, i.e. XBRL? This question is addressed through an updated model of XBRL continuance based on ECT (Figure 2).

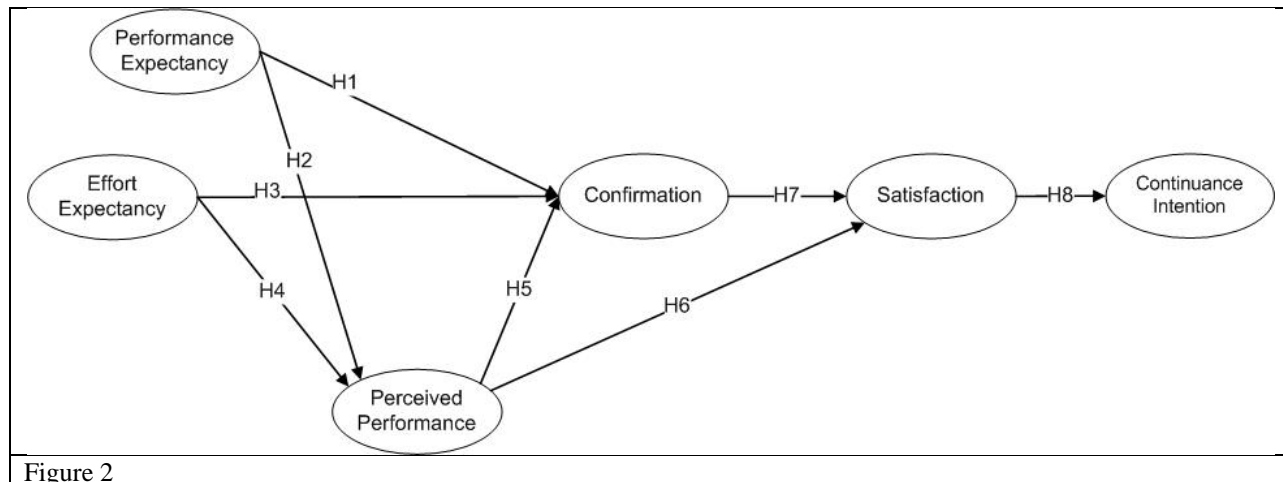


Figure 2

Founded on the theory and research discussed above, the research model illustrated in Figure 2 highlights the role of two expectations (performance expectancy and effort expectancy) and perceived performance in influencing satisfaction with XBRL through the confirmation or disconfirmation of those expectations. The relevant expectations related to XBRL continuance are the expected performance of the system (Performance Expectancy) and the effort required to learn XBRL (Effort Expectancy). The dependent variables of interest are satisfaction with XBRL and continuance intention with XBRL.

Our research model is temporal in that performance expectancy and effort expectancy are measured pre-usage of XBRL, and the remaining constructs are measured post-usage. We are determining if the initial expectations (pre-usage) of Performance Expectancy and Effort Expectancy influence the post-usage 1) confirmation / disconfirmation of XBRL expectations and 2) the perceived performance of XBRL.

*Pre-Usage Constructs (Expectations)*

The construct of Performance Expectancy is related to the perceived performance of XBRL in increasing the user's overall accounting skills and in helping the user attain gains in job performance. This construct is adapted from the UTAUT model of user acceptance (Venkatesh et al. 2003). Because the benefits of XBRL have been highly touted by the SEC, we hypothesize that users will have high expectations of XBRL and that these high expectations will not be confirmed through actual usage of XBRL. Therefore, we hypothesize the following:

*H1: There is a negative association between performance expectancy and confirmation.*

*H2: There is a negative association between performance expectancy and perceived performance.*

Effort expectancy is defined as the degree of ease associated with use of a system (Venkatesh et al. 2003), and in our case, the degree of ease associated with learning XBRL. This construct is also adapted from the UTAUT model of user acceptance (Venkatesh et al. 2003). We expect that users will perceive XBRL to be easy to learn and that these expectations will be confirmed after the XBRL training. We also expect that this effort expectancy (pre-usage) will be positively associated with the perceived performance (post-usage). Therefore, we hypothesize:

*H3: There is a positive association between effort expectancy and confirmation*

*H4: There is a positive association between effort expectancy and perceived performance*

### *Post-Usage Constructs*

The initial expectations during the pre-usage phase are the comparison standard in ECT and are the basis for how the user evaluates the technology. If actual performance results in perceptions that outperform expectations, then the expectation is confirmed. If actual performance deviates negatively from this expectation, then the expectation is not confirmed (or disconfirmed). Confirmation is measured by asking the respondent whether XBRL is better than or worse than expected.

The construct of Perceived Performance measures post-usage perceptions of the benefits of XBRL. The construct of satisfaction measures overall satisfaction with the respondent's XBRL experience. The construct of continuous intention measures the intention of the respondent in continuing to use XBRL. The measures are listed in the appendix.

For hypotheses 5-8, the relationships are established through ECT. Therefore, as predicted by ECT:

*H5: There is a positive association between perceived performance and confirmation*

*H6: There is a positive association between perceived performance and satisfaction*

*H7: There is a positive association between confirmation and satisfaction*

*H8: There is a positive association between satisfaction and continuance intention*

## **Method and Results**

### ***Study Context and Sample***

The research was conducted using a two-phase survey approach, with the instruments tailored to the context of the adoption and continued use of XBRL. The respondents were undergraduate accounting students enrolled in an accounting information systems (AIS) course. The respondents were 61.3% female and 38.7% male with an average age of 22.59 years. Following a conceptual introduction to XBRL, the phase 1 survey measures of participant demographics, experience, performance expectancy, and effort expectancy were captured. One week after capturing the phase 1 measures, the participants worked on an exercise centered on using XBRL to transmit financial data between software applications. After completing the exercise, the phase 2 survey was deployed, capturing measures of perceived performance, confirmation, satisfaction, and continuance intention. A total of 75 undergraduates participated in the study.

### ***Construct Operationalization***

Scales for the constructs in the model were developed for this study by adapting scales from prior research on ECT. Specifically, measures for performance expectancy and effort expectancy were adapted from (Venkatesh et al. 2003). The remaining constructs in the model—perceived performance, confirmation, satisfaction, and intention—were adapted from Bhattacharjee (2001). Details of the measurement items used in each of the constructs are provided in Appendix A.

### ***Data Analysis and Results***

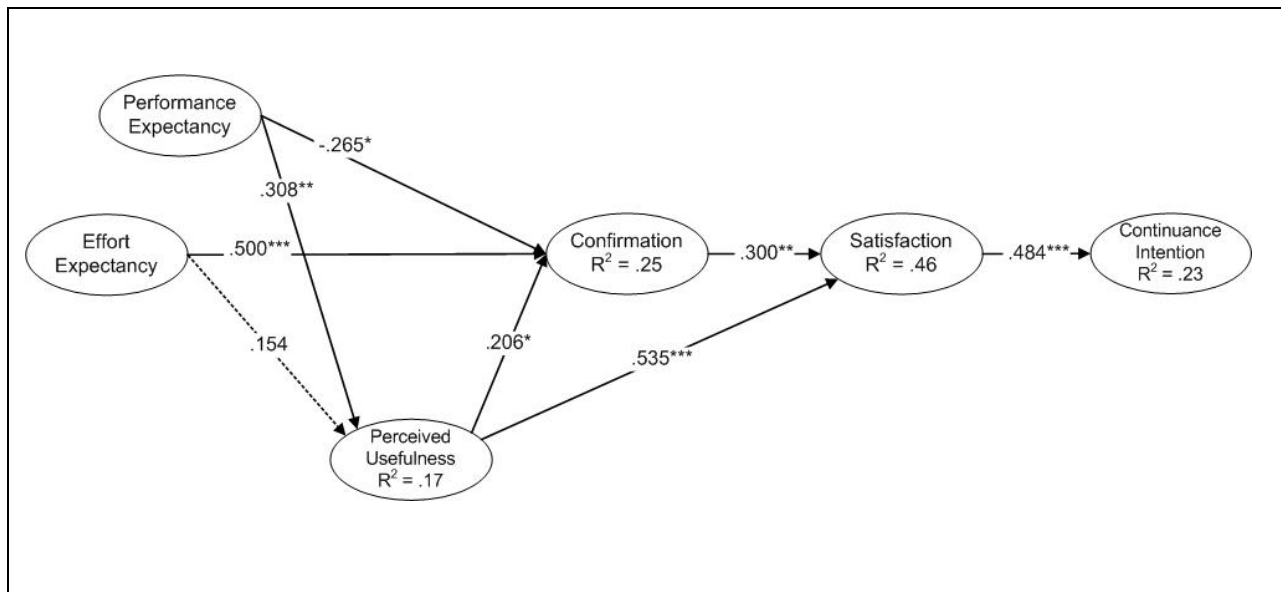
The measurement model was first assessed via a confirmatory factor analysis. The results of the confirmatory factor analysis indicated a problem with one of the items assessing confirmation (CONF2), as indicated by a low factor loading (Nunnally 1978). After removing the item from the model, the structural equation modeling (SEM) technique of Partial Least Squares (PLS) was employed to test the model. Discriminant validity was first assessed by determining whether the indicators for each of the latent constructs loaded more strongly on their intended construct than any other latent constructs in the model as well as whether the square root of the average variance extracted (AVE) for each construct is larger than the inter-construct correlation (Chin 1998). As shown in Table 1, all constructs shared more variance with their intended indicators than with other constructs; in addition, composite reliability scores indicated good internal consistency.

**Table 1. Inter-Construct Correlations**

	Reliability	CONF	E_EXP	INTENT	PER_USEF	PER_EXP	SATIS
CONF	0.916	0.919					
EFF_EXP	0.935	0.431	0.885				
INTENT	0.931	0.289	0.253	0.905			
PER_USEF	0.939	0.259	0.308	0.674	0.890		
PER_EXP	0.855	0.065	0.500	0.177	0.385	0.815	
SATIS	0.918	0.439	0.303	0.484	0.613	0.142	0.888

*Notes: Shaded numbers on the leading diagonal are the square root of the variance shared between the constructs and their measures. Off diagonal elements are correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.*

Figure 3 provides the path coefficients and the explained variance for the structural model.



**Figure 3. PLS Results**

## Discussion / Conclusion

As illustrated in Figure 3, all of the hypotheses in the model except for H4 were statistically significant at the level of  $p < .05$ . Overall, the results suggest that the performance and effort expectations held by the individual do bear influence on the post-training perceptions and satisfaction with XBRL, which subsequently drives intention to further engage in learning about the technology. While most of the hypotheses were confirmed, the link between effort expectation and perceived performance (H4) was not confirmed. One possible explanation for this unexpected result is that, prior to having a hands-on understanding of the technology in the learning context, effort associated with using the technology is not considered. Instead, focus is on understanding the performance implications of the technology. Another possible explanation is that nuances of the technology itself prevented the formation of clear effort expectations surrounding the technology prior to exposure. Future research is invited that further explores this relationship.

Another hypothesis of interest is H2. While we originally hypothesized a negative relationship between performance expectancy and perceived performance (in that it would be difficult for high expectations of XBRL performance to be realized), the actual outcome was a positive relationship. This result is an indication that students were able to understand the usefulness of XBRL to the accounting profession.

Overall, the findings from this research highlight belief formation process when learning about a new technology, and the impact of initial perceptions on subsequent satisfaction and continuance intention. Educators and trainers are encouraged to understand this sequential process and tailor programs to accommodate this process. The negative relationship between performance expectation and confirmation highlights the notion that, prior to exposure, expectation management should be a component of the training process. Over-inflating performance expectations may motivate students in the short term and influence positive perceptions of the technology; however, this can have a negative effect on confirmation in the long term, undermining continuance intention.

In summary, this research leveraged ECT to develop a model of new-user education of XBRL which highlights the existence of an expectations gap in the learning process. The model was tested via a two-phase longitudinal field survey in the context of XBRL training of accounting students. Overall, the results provide insights into the role of expectations and belief formation in the learning process, and its overall impact on continuance intention.

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## Appendix A – Scales and Items

### **Performance Expectancy** (Adapted from Venkatesh et al. 2003)

- PER\_EXP1 I would find XBRL useful in my current or next accounting position.
- PER\_EXP2 Using XBRL increases productivity in producing financial statements.
- PER\_EXP3 If I know XBRL, I will increase my chances of getting a job.

### **Effort Expectancy** (Adapted from Venkatesh et al. 2003)

- EFF\_EXP1 My interactions with XBRL will be clear and understandable.
- EFF\_EXP2 It will be easy for me to become skillful at using XBRL.
- EFF\_EXP3 I would find XBRL easy to use.
- EFF\_EXP4 Learning to use XBRL will be easy for me.

### **Perceived Performance (Usefulness)** (Adapted from Bhattacharjee 2001; Venkatesh and Davis 2000)

- PRCVD\_P1 XBRL is of benefit to me.
- PRCVD\_P2 The advantages of XBRL outweigh the disadvantages
- PRCVD\_P3 Using XBRL increases my productivity
- PRCVD\_P4 Using XBRL increases my overall effectiveness
- PRCVD\_P5 Overall, XBRL is useful

### **Confirmation** (Adapted from Bhattacharjee 2001)

- CONF1\* *My experience with using XBRL was better than what I expected*
- CONF2 My experience with XBRL was exactly what I expected.
- CONF3 Overall, my experiences of using XBRL were confirmed.

*\*Item dropped due to factor loading < .4 during a confirmatory factor analysis*



**Satisfaction** (Adapted from Bhattacharjee 2001)

How do you feel about your overall experience with use of XBRL?

SATIS1 Satisfied

SATIS2 Pleased

SATIS3 Frustrated

SATIS4 Delighted

SATIS5 Terrible

**Continuance Intention** (Adapted from Bhattacharjee 2001)

CONT1 I intend to continue using XBRL rather than use any alternative technology

CONT2 If I could, I would like to continue my use of XBRL

CONT3 I intend to continue using XBRL rather than discontinue its use

# **The Effects of Technology-Mediated Collaboration on Shared Mental Model and Task Outcomes**

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## **ABSTRACT**

This study takes a direct observation research approach to examine how the impact of collaboration mode on team productivity and process satisfaction is mediated by shared mental model. Team cognition and social impact theories are integrated to provide a framework for explaining how technology-mediated collaboration constrains or enhances team shared mental model development and its subsequent impact on task outcomes. The results demonstrate that accurate development of shared mental model helps to facilitate increased productivity and team process satisfaction.

## **INTRODUCTION**

Companies are increasingly turning to a new business model, the virtual organization, where virtual teams are constructed with individuals that 1) are geographical dispersed, 2) are linked via collaboration technologies, and 3) collaborate across time and space in synchronous and/or asynchronous mode (Garton & Wegryn, 2006). As such, a greater understanding of team processes during technology-mediated collaboration is critical to their effective use. A review of the technology-mediated collaboration literature reveals a shortage of qualitative studies that have investigated higher order information processing and cognitive factors such as team shared mental model and distributed expertise utilization (Hasty, Massey & Brown, 2006; Majchrzak, Beath, Lim & Chin, 2005; Miranda & Saunders 2003). This study addresses that shortage by using an observational research approach to examine the mediating effects of shared mental model on task outcomes by trained observer ratings of task-related and affect-related communication exchanges.

In this study, the following research questions are addressed:

- (1) What observable behaviors are indicative of shared mental model construction?
- (2) How does technology-mediated collaboration impact behavior associated with shared mental model construction?
- (3) Through what mechanisms do shared mental model facilitate productivity and satisfaction outcomes?

In what follows, the next section reviews the relevant literature on the role of shared knowledge of task content and task situation awareness and social influence on facilitating coordinated effort. The next section presents a research model and hypotheses. The third and fourth sections describe the research methodology and data analysis results, respectively. The final section discusses the findings.

## **LITERATURE REVIEW**

### **Team Cognition and Shared Mental Model**

Team cognition refers to the ways in which teams process and use information (MacMillan, Entin, & Serfaty, 2004). During team cognition, shared information is organized into coherent chunks of causally-related facts or knowledge structures which are used to guide behavior and decision-making. These knowledge structures are often referred to in the literature as schemas (e.g., Rentsch & Woehr, 2004) or mental models (e.g., Klimoski & Mohammed, 1994). Although there are many different definitions of mental models, most define mental models as task-related and team-related knowledge (Cooke, Kiekel, Salas, Stout, Bowers & Cannon-Bowers, 2003; Fiore, Salas, & Cannon-Bowers, 2001). Task-related knowledge refers to knowledge of task procedures, strategies, contingencies, and environmental constraints. In contrast, team-related knowledge refers to awareness of the knowledge, skills, abilities, and behavioral tendencies of team members.

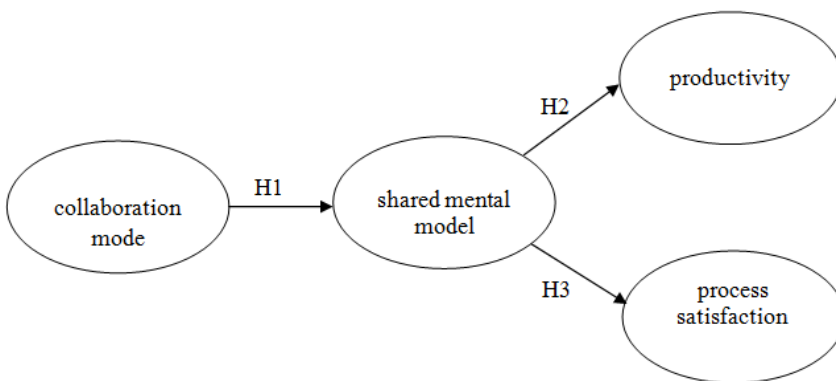
### **Social Impact Theory**

Social Impact Theory (SIT) is defined as changes in feelings, motivations, and behaviors that occur in an individual as a result of the real, implied, or imagined presence or actions of

other individuals (Latane, 1981). In a group context, SIT suggests that team member attitudes, feelings and behavioral outcomes would be a function of three dimensions that define a group interaction session - *strength, immediacy, and number*. *Strength* refers to influence that one or more members can exert on others. *Immediacy* refers to the influence of time lapse between team member exchanges or spatial proximity (i.e. physical distance between team members). The *numbers* dimension expresses the quantity of influential sources. The three dimensions exert social influence on team member behavior during problem solving.

## RESEARCH MODEL AND HYPOTHESES

The research model is depicted in Figure 1 below. The model suggests that collaboration mode will impact shared mental model development. It also proposed that that shared mental model is an intervening factor in collaboration mode’s effect on productivity and team process satisfaction.



**Figure 1. Research Model**

### Collaboration Mode and Shared Mental Model

Dennis et al. (2008) noted that that technology-mediated collaboration can be inferior to face-to-face collaboration because of its ability to facilitate the construction of verbal information or messages that are supplemented with physical gestures or nonverbal cues (e.g., postures, facial expression, eye gaze, tone of voice, and conversation pauses). These nonverbal cues function as feedback that confirms or disconfirms understanding and controls turn-taking. SIT suggests that lack of team member proximity associated with technology-mediated collaboration can limit motivation for team member participation needed to offer and evaluate

ideas that could be used by the group in shared mental model development. The diminished motivation can be attributed to failure to attribute salience or credibility to contributions from distant team members (via lower experienced *strength*, *immediacy* and *number* effects) and through efficacy-based disengagement tendencies (Blaskovich, 2008; Chidambaram & Tung, 2005). Thus the following hypothesis is proposed.

**H1:** *Groups collaborating in the face-to-face settings will develop a more accurate shared mental model of the task requirements and task status than the technology-mediated groups.*

### **Shared Mental Model and Task Outcomes**

In addition to regulating participation, shared understanding has also been linked to the quality of ideas suggested and thoroughness of team discussions (Banks & Millward, 2007; Miranda & Saunders, 2003; Van Ginkel & Van Knippenberg, 2008). A shared mental model can also facilitate the creation of cooperative goals via a set of shared interpretations of task requirements and appropriate task solution (Tjosvold, Yu & Chun, 2004). Further, cooperative goal settings have been associated with maintenance of a shared focus, positive interpersonal interactions, and satisfaction with task solution (De Dreu, 2007; Hogel & Gemuenden, 2001; Hoegl, Weinkauff & Gemuenden, 2004). Hence, the following hypotheses are proposed.

**H3:** *Greater accurate shared mental model will be associated with greater team productivity.*

**H4:** *Greater accurate shared mental model will be associated with greater satisfaction.*

## **RESEARCH METHODOLOGY**

### **Experimental Design**

To test the research model and hypotheses, a laboratory experiment was conducted to examine the effects of two different modes of team collaboration – face-to-face and technology-mediated collaboration. Four person teams were used throughout both conditions. The technology-mediated collaboration setting was configured as a pair of dispersed collocated dyads seated at a table and communicated with the other dispersed dyad via a videoconferencing system (i.e. a fully integrated microphone, speaker and large video display system). In the face-to-face collaboration mode, all four subjects sat across from each other at a conference table. No

content sharing technology options (e.g., shared whiteboard or shared desktop) were needed to complete the experimental task by either of the collaboration modes.

## **Participants**

In this study, 48 participants were drawn from a population of Management Information Systems undergraduate students familiar with the Systems Development Life Cycle approach to software design and knowledge of structured programming. For their participation, extra credit was awarded and each design team was eligible to receive a \$100 award for the highest team productivity score under each of the experimental conditions (i.e., face-to-face and technology-mediated).

## **Task and Procedure**

The teams were required to enhance the functionality of a hypothetical university information system. The experimental task required each team to construct software design documentation that included (1) a hierarchy chart, (2) a list of function prototypes, and (3) pseudocode for each function identified as part of a solution to the problem. The experimental task duration was 2.5 hours. In order to ensure the manipulation of a demand for team-wide communication, each subteam possessed a unique set of half of the task instructions and was required to share their unique instruction set with the other subteam.

## **Measures**

The behavioral observation approach was used in assessing shared mental model by using three trained observer ratings of task-related and affect-related behaviors. The observers/raters underwent a 2-hour training session that reviewed construct definitions and relevant behavioral indicators to provide a rating (Bakeman, 2000). Overall team ratings were comprised of the sum of ratings of one twenty-minute interval at the midpoint and the last twenty minute interval of the overall 2.5 hour session.

**Treatment Variable: Collaboration Mode.** The collaboration modes utilized to form the experimental conditions were face-to-face collaboration and technology-mediated collaboration via videoconferencing. Recent research has shown that both collaboration modes differ in the capacity to which they impact communication efficiency, shared understanding and

team interactions (Blaskovich, 2008; Chidambaram & Tung, 2005; Fiol & O'Connor, 2005; Furumo, 2009; Kanawattanachal & Yoo, 2007).

**Shared Mental Model.** The shared mental model rating scale was comprised of four items that assessed behaviors that reflected the degree of 1) shared understanding of task requirements, 2) solution consensus, 3) confusion of task requirements and status, and 4) extent of needed explanations and clarifications (Banks & Millward 2007; He et al. 2007; Kanawattanachal & Yoo, 2007; Van Ginkel & Van Knippenberg, 2008). Three trained raters rated shared mental model development using a 7-point scale ranging from 1 (very low) to 7 (very high). The interrater reliability for the shared mental model scale was 0.818 ( $p < .001$ ) indicating very good interrater agreement (Cicchetti, 1994).

**Team Productivity.** A research assistant, unaware of the study's objectives, computed the team productivity as a combined score on the completeness of file design (i.e. appropriate data fields), specification of function prototypes (i.e. function name, parameters and return type), and pseudocode for each function. A point was awarded for each correct specification of any data value of a specific data file, correct output and input data value of a program module (i.e., function or subroutine), and correct specification of program statement needed in a specific program module.

**Satisfaction.** After task completion, a satisfaction questionnaire elicited individual team member responses regarding the extent to which, while executing the task, there was frustration with behaviors of other team members, confusion during task execution, and satisfaction with the task execution process. This scale was adapted from the set of scale items developed by Green and Tabor (1980). In order to justify aggregation, an interrater agreement statistic using the  $r_{wg(j)}$  procedure (James, Demaree & Wolf, 1984) was computed to assess the convergence of responses among team members. The  $r_{wg(j)}$  values for all teams ranged from 0.94 to 0.98 which conformed to the generally accepted level of .7 as indication of strong within-group agreement. The scale reliability (Cronbach's alpha) for the satisfaction scale was 0.859.

**Control variables.** Programming ability is an important variable that can influence a participant's performance. To minimize the influence of this variable on performance, programming ability was measured and used as a covariate in the analysis. The index of programming ability was determined for each subject by a grade received in an upper level programming course (Balijepally et al. 2009, Quigley, Tekleab and Tesluk 2007).

## **Data Analysis**

Measurement model validation and structural model testing was conducted using PLS (partial least squares, PLS-Graph version 3.00) where regression is performed on only a portion of the model at any one time (Chin, 1998). The sample size of 12 four-person teams conforms to the sample size recommendation of 5 to 10 times the largest number of structural paths leading into to any one construct given the construct is measured with reflective indicators (Chin & Newsted, 1999). Appropriate tests revealed that this study's sample conformed to accepted constraints used to assess small sample adequacy (Marcoulides, Chin, & Saunders, 2009).

## **RESULTS**

### **Measurement Model**

Regarding internal consistency (reliability), composite reliability scores for shared mental model and team satisfaction were 0.970 and 0.900 respectively as shown in Table 1) both of which are well above 0.70, which is the suggested benchmark for acceptable reliability (Chin, 1998; Majchrzak et al. 2005). Table 1 indicates that all of the item-to-construct loadings are at 0.746 or above and the t-statistic for the item to construct loadings are all significant at  $p \leq 0.01$ . These results indicate that the measurement model has displayed both item internal reliability and item convergent validity. Table 2 below shows that the correlations of each item to its intended latent variable (i.e., loadings) were higher than on all other constructs (i.e., cross loadings). Table 3 below indicates that the square root of every construct's AVE (on the diagonal) is larger than any correlation of that construct with any other construct. This AVE analysis result and the item to construct loadings discussed above suggest that the measurement model displays discriminant validity.



**Table 1. Composite Reliability, AVE, and Indicator Loadings**

Construct and Item Level Values		loading	t-statistic	p-value
<b>Shared Mental Model (Composite Reliability = 0.970; AVE = 0.889)</b>				
smm1	It was clear that everyone developed the same level of understanding of the task requirements.	0.922	29.231	$p \leq .01$
smm2	There was some difference of opinion or concern about the correctness of the proposed solution.	0.961	24.054	$p \leq .01$
smm3	There was significant confusion about what was going on.	0.945	4.907	$p \leq .01$
smm4	Some team members required a lot of explanations about what was going on.	0.943	8.6997	$p \leq .01$
<b>Process Satisfaction (Composite Reliability = 0.900; AVE = 0.643)</b>				
satisfac1	To what extent did you feel frustrated or tense about another team members' behavior?	0.795	6.074	$p \leq .01$
satisfac2	To what extent did you express negative opinions about another team member's behavior?	0.768	4.138	$p \leq .01$
satisfac3	To what extent did you observe others express negative opinions about your behavior?	0.834	9.190	$p \leq .01$
satisfac4	How confusing was the task execution process?	0.862	6.561	$p \leq .01$
satisfac5	How satisfying was the task execution process?	0.746	3.487	$p \leq .01$

**Table 2. Indicator Loadings**

Latent Variable Item Loadings		
Indicator	shared mental model	satisfaction
smm1	.922	.649
smm2	.961	.697
smm3	.945	.622
smm4	.943	.680
satisfac1	.515	.795
satisfac2	.619	.768
satisfac3	.573	.834
satisfac4	.634	.862
satisfac5	.438	.746

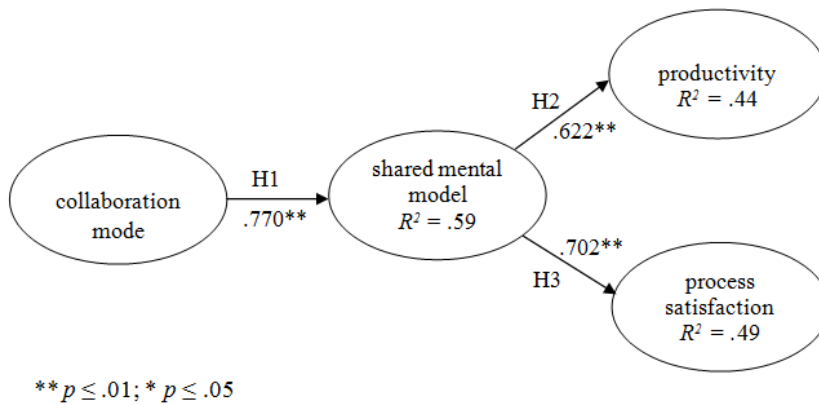
**Table 3. Latent Variable correlations and square root of AVE**

	shared mental model	satisfaction
<b>shared mental model</b>	<b>0.985</b>	
<b>team satisfaction</b>	0.703	<b>0.950</b>

Note: square root of the constructs' AVE appear in the diagonal

## Structural Model

In PLS analysis, a structural model can be evaluated on the basis of strong indicator to construct loadings,  $R^2$  values, and significance of the structural path coefficients (Chin 1998). Figure 2 below shows that all of the paths are significant at the 0.01 level. In addition, the model accounts for 44 to 59 percent of the variances ( $R^2$  scores). The hypothesized model provided the best fit to the data (i.e. largest explained variance) than all other alternative causal path configurations among the variables.



**Figure 2. PLS Analysis Results**

The PLS analysis results (Figure 2) show that all of the hypotheses were supported. Collaboration mode was shown to increase shared mental model development ( $b = 0.770$ ,  $t = 4.988$ ,  $p \leq .01$ ). Face-to-face groups had a mean shared mental model rating score of 107.25 while the technology-mediated groups had a lower mean score of 70.25. Shared mental model increased team productivity ( $b = 0.622$ ,  $t = 3.003$ ,  $p \leq .01$ ) and team satisfaction ( $b = 0.702$ ,  $t = 6.898$ ,  $p \leq .01$ ). Mediation test results showed that shared mental model fully mediated the impact of shared mental model on both productivity and team satisfaction.

## DISCUSSION AND CONCLUSION

Direct observation revealed support for hypothesis 1 in that the technology-mediated collaboration mode exhibited greater lags between information exchanges, fewer information seeking attempts, greater incoherent exchanges, greater need to repair misunderstandings and diminished team-wide participation all of which limited timely and accurate shared mental model development. A shared interpretation of task requirements and appropriate solutions promoted

efficiency by minimizing processing of irrelevant information which made it easier to arrive at consensus regarding the task solution thereby supporting hypothesis 2. Finally, as proposed in hypothesis 3, shared mental model was shown to have a positive effect on team satisfaction. In summary, the overall finding of this study is that technology-mediated collaboration can limit collective contribution from team members, critical analysis of information, and interpretation and solution consensus needed to construct a shared mental model. In addition, viability of the direct observation approach as an additional data collection method for use in methodological triangulation (Denzin, 2006) has been demonstrated.

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# **ACADEMIC SUCCESS FACTORS FOR INFORMATION TECHNOLOGY STUDENTS**

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## **INTRODUCTION**

Learning is defined as gaining knowledge or modifying behavioral tendencies through study, instruction, experience or conditioning (Merriam-Webster On-Line, 2009). Accordingly, the learning process is not limited to conscious intellectual activity, but is affected by a wide variety of internal, external, environmental and experiential factors.

In this study, we explore student perceptions of the factors that affect their academic success. Our ultimate goal is to develop a survey that captures these perceptions. Previous research as well as the results of a short, preliminary pilot survey (described in the "Methodology" section) will guide our survey development. Once the survey instrument is complete, our intention is to administer the survey first to students in our discipline and later to a wider cross-section of students.

## **BACKGROUND**

A number of studies have investigated the effect of factors other than one's cognitive process on academic success. Weiner (1971) provided a theoretical framework to characterize the causal attributions that affect learning. The framework consisted of two dimensions: the internal/external dimension and the stable/unstable dimension. Four components - ability, effort, task difficulty and luck - were classified within this framework. Weiner (1979) later added a third dimension, controllability, to the framework.

Ritchey and Lewis (1986) also classified factors that impact learning into four categories: (1) personal (internal), (2) environmental (external), (3) academic, and (4) nonacademic. They found that personal academic factors accounted for a significant increase in grade performance, and that environmental factors tended to affect disadvantaged students more than others. They found that reading comprehension ability was the best overall predictor of academic success.

A number of other studies have investigated personal characteristics such as gender, age, psychological characteristics, cognitive learning styles and mental abilities as predictors for academic success. McKenzie & Schweitzer (2001) found academic, psychosocial, cognitive, and demographic factors to be good predictors of academic performance. In their study the most

significant predictor of success was previous academic performance. They also found that integration into the university, self efficacy, and employment responsibilities were related to GPAs. Other studies suggest that learning styles (Ross, Drysdale & Schulz, 2001; Zhang & Richarde, 1997) and inductive reasoning ability (Kinshuk & McNab, 2006) are significant in predicting academic performance.

External factors have also been investigated. Trockel, Barnes and Egget (2000) found that early wake-up times, fewer hours worked per week (volunteer or paid), strength training and study of spiritually oriented materials were associated with higher GPAs. Extending the Trockel et al. (2000) study, George, Dixon, Stansal, Gelb and Pheri (2008) found that clearly defined goals, time-management skills, less time spent in passive leisure, healthy diet, rising early, computer ownership and less time sleeping were predictors of "total success" - the combination of academic success as measured by GPA and personal success.

Numerous environmental factors have also been studied. The influence of the family's social and economical background was investigated by Demeulemeester & Rochat (1995). They found that prior academic achievement, motivation to achieve high grades, classroom environment, course load, number of contact hours and quality of instruction all had an impact on academic success. Yan and Gaier (1994) found cultural differences between American, Chinese, Japanese, Korean, and Southeast Asian students in perception of the magnitude of the impact of effort, ability, task and luck as influential factors on academic success.

In a study of instructional factors, Aysan et al. (1996) found that students perceived teacher behavior, teaching methods, subject content, examinations, lack of commitment to study, and psychological problems as factors that contributed to their failure in a particular subject course or courses.

Several studies have considered multiple factors simultaneously and the interactions among them. For example, Bruinsma & Jansen (2007) reported that grades, motivation, age, prior achievement, home environment, support from peers, classroom environment, quality of instruction, and quantity of instruction explained 23% of the variance in achievement.

The data utilized in the majority of these studies was drawn from survey instruments in which students rated predefined factors in terms of perceived importance to their academic success or failure. The purpose of this study is to explore whether there may be additional factors that are missing from the previous studies, and if so, to develop a comprehensive survey that incorporates those missing factors with the factors identified in previous studies.

## **METHODOLOGY**

To determine what factors are critical to the academic success of students, an open-ended paper-based survey was administered to 131 upper-level (third year or beyond) students majoring in IT-related degree programs at Georgia Southern University. The rationale for using upper division students is that they have the academic experience to recognize the factors that contribute to their successes and failures in college. Given the exploratory nature of this preliminary study, the sample is limited to students in IT-related programs. This sample was chosen as a matter of convenience. The breakdown of students by year in college is given in Table 1.



**Table 1: Breakdown of students by year in college**

Third year	16.03%
Fourth year	48.09%
Fifth year	29.01%
Sixth plus year	6.11%
Unknown (1 student)	0.76%

The students were asked "What does it take to be successful in college? Please give ten factors that lead to academic success or failure." The survey was administered in selected core courses in the three IT-related majors at Georgia Southern: Information Systems, Information Technology, and Computer Sciences.

## RESULTS

To determine which factors were important to students, the authors listed all responses provided by the students and calculated the frequency of the responses. For ease of interpretation, the responses were categorized into four categories: skills and traits, habits, support and environment, and teaching and advising.

Responses that did not have reasonably high frequencies (more than 6 students citing that factor, a rate above 5%) were omitted from the results. There were 45 factors that had high enough frequencies to be included. There were 7 skills and traits, 19 habits, 8 factors related to support and environment and 11 related to teaching and advising. Tables 2 – 5 provide the factors in each of the four aforementioned categories, respectively. Percentages do not add up to 100% as each student listed multiple factors.

**Table 2: Skills and traits students cited as important to academic success**

<b>Factors Listed by Students</b>	<b>Percent of Students</b>
Commitment/ Dedication/ Hard work	19.85%
Focus	10.69%
Self-motivation/ Initiative	9.16%
Persistence/ perseverance/ desire	9.16%
Patience	6.11%
Positive attitude	6.11%
Discipline	5.34%

## DISCUSSION

The results of this preliminary study will be used to inform the development of a broader survey instrument that will be used in future studies. The broader survey will incorporate our preliminary findings with the factors identified in previous research as being important to

academic success. Our intention is to ultimately administer the survey to a larger sample of students in IT-related disciplines (and later to a wider cross-section of students). It is our hope that the data gathered through these efforts will not only give us better insight into the factors that lead to academic success, but also help us identify ways to improve the academic success of our students.

**Table 3: Habits students cited as important to academic success**

<b>Factors Listed by Students</b>	<b>Percent of Students</b>
Study	55.73%
Attend class	42.75%
Time/task management	31.30%
Participate/ ask questions/ pay attention/ don't sleep in class	27.48%
Balance between school, social life and home life	25.19%
Stress outlet (exercise, outside life, have fun, me time, etc)	24.43%
Sleep	23.66%
Do HW (graded and ungraded), practice	21.37%
Don't procrastinate/ Be Proactive	19.85%
Be organized	17.56%
Read	16.03%
Good notes/ take notes	16.03%
Use study groups	14.50%
Extra-curricular activities (in school and outside)	12.98%
Group work/ teamwork	12.21%
Flexible work schedule/ job or no job	11.45%
Drug free/ no peer pressure/ limit or no alcohol	9.92%
Prioritize	8.40%
Set goals	8.40%

**Table 4: Factors related to support and environment students cited as important to academic success**

<b>Factors Listed by Students</b>	<b>Percent of Students</b>
Friends support/ make friends	35.11%
Network (other students/mentors)	16.79%
Family support	14.50%
No financial concerns	14.50%
Diet/ exercise	12.21%
Reliable transportation	7.63%
Price of books (buy online, cheaper)	6.87%
Good living environment (roommates, etc.)	6.11%

**Table 5: Factors related to teaching and advising students cited as important to academic success**

<b>Factors Listed by Students</b>	<b>Percent of Students</b>
See professors/ get to know them/ communicate/ availability	41.98%
Good professors (motivated, interesting, well-prepared)	26.72%
Finding/ asking for help	12.21%
Language barrier with professor	9.16%
Choose appropriate major	8.40%
Tutors	6.11%
See advisor (academic, career, professor)	5.34%
Don't over schedule	5.34%
Have an academic plan	5.34%
Review for test provided (study guides, format of test)	5.34%
Types & frequency of tests (multiple choice, essay, related to material)	5.34%

In a different vein, the results of our preliminary study also offer some more immediate pedagogical insights for us to consider as educators. Table 2 suggests that students perceive commitment, dedication and hard work as the most important skill/trait for their own academic success. This is followed by focus, self-motivation, persistence, patience, positive attitude and self-discipline. In the university environment, faculty have limited ability to help students develop these skills and traits as these are personal characteristics the student will already possess prior to arrival on our campus.

We are, however, in a better position to help develop the habits listed in Table 3. Among the habits students perceived to be the most important are to study, attend class, manage their time, actively participate in class, complete homework assignments, avoid procrastination, stay organized, take notes, use study groups, prioritize and set goals. Through the design of our course syllabi, academic programs and broader curricula we have the ability to address the development of many of these habits. As George et al. (2008) suggests "*... perhaps it is time for universities to more prominently incorporate classes in goal-setting and time-management skills.*" At many universities, these topics are discussed in freshmen orientation courses. However, additional upper-division courses that stress the value and importance of these habits may be needed. George et al. (2008) also suggest that "*... universities would be wise to require a class devoted to principles of lifelong health and fitness*" – something students also recognize as important to their academic success (see Table 2).

As suggested by Table 4, we can also emphasize the importance of friends and networking to the academic success of our students. By encouraging our students to participate in student organizations, attend alumni events, and take advantage of opportunities to meet external constituents (such as members of external advisory boards, guest speakers, etc.) we can foster their involvement in valuable networking opportunities on campus.

In Table 5, the accessibility of professors is the most commonly cited factor that contributes to the academic success of students. Students value good professors that are interesting, motivate them and are well-prepared. This emphasizes the importance of professional development in the area of teaching for faculty members and the importance of sponsoring events/activities that include both faculty and students.

### **LIMITATIONS AND FUTURE RESEARCH**

This study is limited by our sample size and composition, and by the fact that our sample is a sample of convenience. Future studies will be based upon larger, more diverse samples. Once our broader survey instrument is developed, we will administer it to a larger sample of students in IT-related programs (both on our campus and at other institutions). Later, we will also administer the survey to non-IT students so that comparisons can be made among students in various majors. We also plan to administer the study to lower division students so that comparisons may be made between upper division students and freshmen/sophomores.

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# Accommodating Cloud Computing in the Curricula of Schools of Computer Science and Information Systems

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## Abstract

Cloud computing, technology services accessible through a browser and residing in the Internet “cloud” (or in Intranets or Extranets for private clouds), is an unavoidable extension of Service-Oriented Architecture. Cloud computing is potentially the most disruptive technology trend since the arrival of the Internet. The primary cloud services to date are Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS). While the financial benefits of cloud computing will eventually outweigh issues and concerns that hinder wholesale acceptance of cloud computing, educators still have the opportunity to get in front of the trend and help students prepare to reap more of the benefits and avoid more of the potential risks associated with the technology. This paper recommends topics to be considered in modifying existing courses or creating new courses covering cloud technology. The recommendations are organized within nine frameworks of the authors’ previously published Service-Oriented Architecture methodology. Governance, Environment Support, Architecture, and Data Management are the frameworks requiring the greatest number of changes to accommodate cloud computing. However, important topics are associated with Requirements/Service Management, Product Realization (development), Project Management, Communications, and Human Resources. These topics will benefit educators considering inclusion of cloud computing in curricula of schools of computer science and information systems.

**Keywords:** cloud computing, public cloud, private cloud, hybrid cloud, Service-Oriented Architecture, SaaS, PaaS, IaaS, curriculum, curricula, updates, methodology, technology management

## Background

The contents of this paper are the result of synergies among three parallel strands of activity. The first, academic research covering Service-Oriented Architecture resulted in publication of a paper looking behind the vendor hype surrounding SOA and defining measurable success factors for SOA implementation (Anderson, Howell-Barber, Hill, Javed, Lawler and Li, 2005). A book (Lawler and Howell-Barber, 2007) further defined considerations for SOA success by evaluating case studies of 15 successful SOA initiatives within the framework of an SOA program methodology. A second paper (Lawler, Raggad and Howell-Barber, 2008) provided recommendations for SOA educational content within the frameworks of an SOA methodology.

The second strand of activity resulted in the methodology with nine frameworks (structures used to organize cross-organizational activities, processes and roles required for technology implementation) discussed in the book and the second paper mentioned above. The methodology evolved from a database of (currently) 13,000 planning activities associated with 60

technology/business roles vetted from over 600 successful (and occasionally unsuccessful) project plans for emerging technology) maintained continuously by the senior author over a period of 40 years.

In the summer of 2008, the authors noted that SOA-related planning activities often referenced services delivered through cloud computing. Cloud computing was viewed as an unstoppable disruptive force that would save money for all adapters. Evangelists of cloud computing encourage potential cloud tenants to focus on the model as a black box, the seamless presentation of information on demand with no need to pay attention to how it works: resources are dynamically allocated, loads are balanced in real time, and data is archived automatically CSA (Cloud Security Alliance, 2009). Developers are likely to welcome the advent of cloud computing with open monitors, because cloud computing is a way for an application creator to abstract away some of the more challenging aspects of building rich, scalable Internet applications (Moore and Hebel, 2009).

However, the CSA recommends that you look under the hood of your cloud providers' offerings and use the broadest precepts of the profession to assure that service engagements meet and exceed requirements, especially in areas of security. The authors have taken up that challenge on behalf of the educational profession, while presenting vendor-neutral recommendations for curriculum content.

The third strand of activity was curriculum research aimed at detailing the potential differences between the job market that students are likely to face and the courses being offered at major educational institutions. A survey of 173 heads of IT in major US organizations (McLaughlin, 2008) indicated that 58% believe cloud computing will cause a radical shift in information technology, 30% are using it already, 10% plan to use it within a year, and 17% are actively researching it. Meanwhile carefully restricted scans of the Internet revealed a 1,700% difference between the number of results returned for "cloud computing" and "planning" (1,400,000 entries) and the number of results returned for "cloud computing" and "curriculum" or "curricula" (81,000).

We need to create a different type of computer scientist and engineer for the 21<sup>st</sup> century (Gallagher, 2009). A major hardware and software provider is already teaming up with 200 universities worldwide to promote its idea of cloud computing. A large proportion of the 81,000 curriculum-related entries mentioned above reference that vendor's approach to cloud computing, and that approach is far from vendor-neutral.

## **Introduction**

The Methodology for Enabling Service-Oriented Architecture (MESOA) and its frameworks began as a repository of plans created by a team of senior "unbundled" IBM consultants who were advising on data automation projects in the late 1960s and early 1970s. Ongoing maintenance of the repository involved capturing new or refined planning activities, roles, business/technology process flows, and best practices identified from successful plans for emerging technology implementations (Krafzig, et. al., 2005). It evolved structure with input from a Project Process in the late 1980's (customized for projects in the financial services

industry) and was expanded to a Technology Systems Management and Modeling Methodology (TeSM) in 1997 as the author's scope of responsibility expanded.

In 2006, it was realized that a technology-wide methodology was required for successful implementation of "BIG" (cross-organizational) SOA. TeSM became the Well-Formed Service-Oriented Architecture (WFSOA) - the Well-Formed concept is associated with eXtensible Markup Language (XML), a critical technology standard for SOA implementation. WFSOA became MESOA in deference to business-focused considerations necessary for SOA implementation, but remained WFSOA when aimed at technologists.

The original six TeSM frameworks (Governance, Project Realization, Architecture, Data Management, Post Implementation, and Human Resources) were increased to nine for WFSOA.

1. The most important new framework, Requirements/Service Management, resulted from the need to understand the cross-organizational effects of creating shared services and processes and the need for better coordination of infrastructure changes with service delivery. Portions of this framework were extracted from the Product Realization Framework and extended with components of the Governance Framework.
2. Problems with interpersonal communication threatened to become an even greater contributor to the failure of cross-organizational SOA projects. Thus, a Communications Framework was extracted from Governance.
3. The need for more talented project managers to enable effective and agile service delivery supported the case for separating Project Management from Product Realization.
4. Finally, the Post Implementation Framework became Environment Management in recognition of the fact that this framework is critical to the end-to-end success of the project.

The nine frameworks used to organize curriculum recommendations for cloud computing are presented below.

**Governance:** The Governance Framework will require the greatest number of upgrades to accommodate cloud computing. This framework enables the alignment of applications, services, and processes with business strategy. It ensures compliance with internal and industry standards and with government regulations while remaining lightweight, strong, and flexible enough to handle the unknowns surrounding emerging technology. The Governance Framework includes features for IT financial management, service and process governance, data governance, and security governance. The Governance Framework also coordinates activities among the other frameworks. Governance-related questions to be answered in a cloud curriculum are:

1. **Agility:** How does the cloud facilitate Agile project management methodology?
2. **Competitive Advantage:** What must organizations do to regain the competitive advantages that may be lost by moving to shared "vanilla" environments?
3. **Compliance and Risk Management:** (a) What compliance requirements will be affected by the move to the cloud (Cloud Security Alliance, 2008)? (b) How would organizations prevent individual business units or departments from using the cloud to side step internal standards and controls? (c) How would audit responsibilities be divided between the



- cloud vendor and the tenant? (d) Who audits the cloud vendor's risk management processes, and how often would the audit occur? (e) How could internal and vendor risk management processes be synchronized?
4. **Financial Considerations:** (a) How would factors for determining return on investment change? (b) Why might overall budgets for existing IT departments increase with cloud computing before they decreased? (c) How would funds for cloud computing be managed? (d) What are the start-up costs for moving applications to the cloud? (e) What are the different pricing models in the cloud and how would they be compared? (f) How would a potential tenant assess a vendor's financial viability? (g) What are vendors' models for recouping their capital investments and how could these affect pricing models? (h) Would cloud vendors pass along savings generated by Moore's Law?
  5. **International Considerations:** (a) Which cloud vendors provide services to the international community? (b) What are the legal implications for international cloud computing? (c) Which vendors conform to international security standards?
  6. **Licensing:** How would licensing agreements and license tracking change in the cloud?
  7. **Partners and Cloud Computing:** (a) How might supply chain partners benefit from sharing private clouds. (b) If an organization's partner moves to the cloud, how might both organizations' processes change?
  8. **Security:** (a) What are the baseline security requirements that should be provided by a cloud vendor? (b) What percentage of the cost savings realized from use of cloud computing services must be invested for increased scrutiny of the provider's security capabilities. (c) What processes do vendors have in place to prevent insider security threats? (d) How would security requirements vary for SaaS, IaaS, and PaaS environments? (e) How would cloud tenant and vendor security administrators divide responsibilities? (f) What is included in security audits and how might these change in a cloud environment. (g) How would organizations handle identification management, authentication management, key management, and encryption in the cloud? (h) What processes should vendors have in place for identifying, correcting, and reporting security breaches? (i) What processes are required for securing test environments and test data in the cloud? (j) What are the benefits of a federated identify management system in the cloud?
  9. **Standards and the cloud:** Which organizations are working on cloud computing standards what is the status of their efforts?
  10. **Strategy and the cloud:** (a) How would cloud tenants synchronize internal technology strategy with cloud vendors' strategies? (b) How would the cloud affect the future business strategies of hardware and software vendors - would they focus on the requirements of the cloud vendors at the expense of tenant organizations?
  11. **Utilization options:** How would potential cloud tenants select utilization options (everything in a public cloud, everything in a private cloud, hybrid clouds)?
  12. **Vendor Interactions:** (a) What cloud vendor alliances are already in place? (b) How are they likely to affect cloud computing? (c) Are vendors likely to play well in the cloud (e.g., how well would a vendor of proprietary software support a customer who has critical applications on an Open Source platform)?
  13. **Vendor Selection:** (a) What are the major cloud vendors, their offerings, and levels of experience? (b) How would you evaluate vendor claims of expertise? (c) What are the vendors' short-term and long-terms plans? (d) How would you compare vendor

performance? (e) What policies, standards, and processes should the procurement specialist evaluate before approving vendor selection? (f) How would a tenant decide when it becomes necessary to change cloud vendors? (g) What information would a potential cloud tenant need to evaluate the risk of vendor lock-in? (h) How would Open Source software help to prevent vendor lock-in?

**Environment Management (Post Implementation):** This framework supports all lifecycle environments with emphasis on production and ongoing adherence to service level agreements (SLA's), deployment, security administration, and problem identification and resolution. The Environment Management Framework will require the second greatest number of upgrades to accommodate cloud computing. Environment Management-related questions to be answered in a cloud curriculum are:

1. **Change Management:** Does cloud computing multiply or reduce change management and deployment risk?
2. **Data Center Operations:** (a) What data center management and infrastructure monitoring tools are available to the cloud tenant? (b) How would skill requirements change for internal data center employees?
3. **Job Scheduling:** How would specialized tenant jobs be coordinated with vendor infrastructure maintenance in the cloud?
4. **Performance Tuning:** How would performance tuning processes work in the cloud (Ouellette, J, 2009)?
5. **Problem Management:** (a) What problem diagnostic tools would be available? (b) How would tenants coordinate internal help desk activities vendors' help desks?
6. **Service Level Agreements:** (a) What would be included in the basic service-level agreement? (b) How would vendors demonstrate adherence to service-level agreements, and how would tenants verify adherence? (c) Could service level agreements be customized, and if so, how would that affect prices? (d) Does the vendor support a priority service model?

**Architecture:** This framework defines the infrastructure and networking required to deliver applications, services, processes, and data. It defines evolutionary processes for dealing with emerging technology. The Architecture Framework will require the third greatest number of upgrades to accommodate cloud computing. Architecture-related questions to be answered in a cloud curriculum are:

1. **Architecture management:** (a) What are the layers in a cloud architecture stack (Reese, 2009)? (b) How could the cloud tenant community participate in the vendors' architecture decisions?
2. **Cloud Service Content:** (a) How can a cloud tenant determine exactly what is being purchased - is the vendor's architecture transparent now, or is it likely to be transparent in the future? (b) How will vendor secrecy affect decisions to move to the cloud? (c) Which service components are proprietary? (d) How is information about scheduling software version upgrades and patches delivered? (e) How is the potential effect on tenants evaluated?

3. **Infrastructure Engineering:** How will skill requirements for architects and engineers in cloud tenant organizations change during and after migration to the cloud?
4. **Multiple Vendors:** How would the selection of multiple vendors to support diverse requirements affect internal architecture decisions?
5. **Networking:** (a) How will networking costs change with cloud computing?
6. **Open Source:** Which vendors are using Open Source software in their offerings and which products are they using?
7. **Operating systems:** (a) Which operating systems are used by major cloud vendors? (b) Are there strategic advantages to using one over the other? (c) How could vendors' operating system choices affect cloud tenants' third-party software choices?
8. **Temporary Cloud Utilization:** What architecture processes are required to create temporary or one-time cloud applications?

**Data Management:** This framework facilitates delivery of data services that increase the effectiveness of both traditional and leading edge initiatives. This framework also ensures data quality and consistency and promotes optimal data redundancy. The ready availability of processing resources in the cloud would also require strengthening this framework, while ensuring that it responded more rapidly to work requests. Data Management-related questions to be answered in a cloud curriculum are:

1. **Capacity Planning:** How would capacity planning change in the cloud (capacity may be virtually unlimited, but how big is the budget for storage space (Allspaw, 2008)?
2. **Data redundancy and replication:** (a) Who will ensure that appropriate replication processes are in place? (b) How will organizations minimize creation of redundant data in the cloud (Fuller and Morgan, 2006)?
3. **Data Security:** (a) Why would encryption be necessary in the cloud? (b) What processes must be established to ensure delivery of encrypted data to the cloud and management of encrypted data within the cloud.
4. **Data Transformation:** What transformation processes must be established to move data to and from the cloud or between vendors if multiple cloud vendors are used.
5. **Database Administration:** (a) Who performs day-to-day administration activities in the cloud, and how would the activities be monitored? (b) Who will be responsible for back up and recovery in the cloud?
6. **Electronic Discovery:** How are requirements for electronic discovery supported by cloud vendors?
7. **Information Lifecycle Management:** What information archiving services are offered by cloud vendors?
8. **Massive data stores:** What are the characteristics of the primary products used to manage massive data stores in the cloud?

**Requirements/Service Management:** This framework enables continued conformance of processes and services to the business strategy defined the Governance Framework. It researches project feasibility and identifies potential risk and requests for redundant services (business or technology), processes, or data before a program or project is approved by considering the gamut of technology initiatives rather than focusing on a single project request. The easy availability of processing resources in the cloud would require strengthening this framework, while ensuring

that it responds more rapidly to work requests. Requirements Management-related questions to be answered in a cloud curriculum are:

1. **Business Analysis:** (a) How will business analysts keep up-to-date with services available in the cloud? (b) What non-functional requirements would business analysts need to understand while gathering application requirements for the cloud?
2. **Candidate Applications:** (a) What are the factors for determining which applications could run safely in a public cloud? (b) Which applications would remain in a private cloud? (c) What industry restrictions and government regulations would affect whether an application is appropriate for the public cloud? (d) What desktop applications could potentially be moved to the cloud?
3. **Development Environments:** What are the significant considerations for establishing a development environment in the cloud (Galrajani and Bowler, 2009)?
4. **Migration Path:** (a) What are the steps in the migration path from piloting cloud computing to a significant use of cloud computing? (b) How could packages of related applications be selected for migration to the cloud? (c) What would be required to move an application from an internal platform to the cloud and vice versa?
5. **Process Management:** How would automated processes work across cloud boundaries?
6. **Silos in the Cloud:** How would organizations prevent individual business units or departments from using the cloud to build redundant applications?
7. **Vendor Change and Configuration Management:** (a) What guarantees should be in place to ensure that vendor configuration changes do not negatively affect the cloud tenant's experience? (b) Would the vendor's need to support multiple tenants affect the speed with which changes could be implemented? (c) If the tenant requires third-party products that are not available on a given platform, would there be a process for requesting the additions?

**Communications:** This framework optimizes information sharing and understanding among program or project participants. It defines and promulgates common reference between business and technology teams. Of greater importance, it improves communication effectiveness within business and technology sectors, thus eliminating a cause of project risk that is often overlooked. Communications-related questions to be answered in a cloud curriculum are:

- 1) **Adoption Time Frames:** What are the benefits to early and late adoption?
- 2) **Cloud of the Future:** Will it ever be possible to deliver cloud computing through a simple interface such as an RJ 45 (Ethernet), an RJ 11 (telephone) jack, or an electrical outlet as vendors often imply?
- 3) **Common Terminology:** (a) What are the definitions of cloud computing - is a private cloud really a cloud? (b) What is a hybrid cloud? (c) How do grid and utility computing relate to the cloud? (d) What are the features of traditional cloud service offerings (SaaS, IaaS, and PaaS)?
- 4) **Current Cloud:** (a) Why is the cloud viewed as a disruptive technology? (b) How could the cloud affect the organizational culture of cloud tenants and software vendors? (c) What is the Open Cloud Manifesto and which vendors support this concept? (d) How is cloud computing related to Green Computing (Lamb, 2009)?

- 5) **History:** What are the steps in the industry's evolution to cloud computing (from timesharing in the late 1960's through the current hypervisors)?

**Product Realization:** This framework enables the analysis, design, development, integration and testing, deployment, and implementation of technology components. At its core are established project management methodology components, minus requirements gathering which has become the core of the Requirements Management framework. Product Realization-related questions to be answered in a cloud curriculum are:

1. **Development Methodology:** What methodology components should be fine-tuned to accommodate development in the cloud?
2. **Development and Scripting Languages:** (a) What languages must developers know to work in the diverse cloud environments (e.g., Java, PHP, Python, or Ajax for \*NIX platforms, GQL for Google, Apex for Force.com, or C# for Microsoft) ((Gift and Jones, 2008) and (Murty, 2008))? (b) How would developers acquire the necessary skills? (c) Would there be requirements for porting COBOL applications to the cloud and which vendors provide tools to support this effort?
3. **Testing:** (a) Can the cloud be used as an effective testing environment? (b) What testing support products will be available from cloud vendors? (c) What determines the test types that could be performed in the cloud?

**Project Management:** This frameworks plans, manages and coordinates activities associated with shorter delivery times, more clients and stakeholders for shared services (both business and technology users) , and two extra layers in the technology stack (e.g., the enterprise service bus (ESB) and service catalogs for service delivery and virtualization/grid software for sharing infrastructure resources). Project Management-related questions to be answered in a cloud curriculum are:

1. **Project Planning:** How would project planning activities change as cloud computing takes hold?
2. **Development Support:** How would tenant and vendor project managers estimate development support requirements in the cloud?
3. **Resources:** How would managers reflect resources from cloud vendor teams in project plans?

**Human Resources Management:** This framework enables identification of new and revised responsibilities for roles of business and technology staff associated with technology delivery. It ensures that skill sets match program or project requirements by enabling appropriate education and training. It helps the organization respond to disruptive changes devolving from the implementation of disruptive technology. Human Resources Management-related questions to be answered in a cloud curriculum are:

1. **Internal Training:** (a) What education or training can companies eliminate or what would they add or change for cloud computing. (b) How would organizations estimate the net effect on education and training budgets?
2. **Staffing Model:** What jobs and roles will be created, modified, or eliminated?

3. *Vendor Training and Certifications:* How are vendors training and certifying their staffs?

### **Methodology**

(The authors will be expanding the paper for a review survey of a sample of best-of class business firms integrating cloud computing framework methodologies and techniques in their operations and technologies.)

### **Analysis**

(The authors will be expanding the paper for an empirical review of the results of the survey of the sample of best-in-class business firms integrating cloud computing framework methodologies and techniques in their operations and technologies.)

### **Preliminary Implications**

1. Cloud curriculum recommendations span the technology industry. Thus, the courses affected could span Information Systems and Computer Science and spread into business management and finance.
2. This paper assumes that faculty and students already understand SOA. When that is not the case, institutions might consider adding SOA topics in parallel with cloud computing.
3. Individuals who already have degrees in technology or business may require additional education to help them work effectively with cloud computing. Thus, graduate, undergraduate, and certificate courses could include cloud computing.
4. Cloud computing is going through rapid evolutionary processes. Educational institutions would have to ensure that curriculum content was adjusted to accommodate the rate of change.

### **Conclusion**

This paper identifies numerous differences between cloud computing topics in a database of information technology syllabi and a database of planning requirements associated with emerging cloud technology. Assuming that economic and industry trends will force information systems strategies that favor cloud computing, the difference between what employers need and what graduating student can deliver is about to widen. The topics in this paper can help instructors in schools of computer science and information systems overcome that difference and achieve an edge over other schools and universities that do not plan for this major trend.

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## **USING YOUTUBE TO IMPROVE STUDENT PERFORMANCE IN A BUSINESS STATISTICS COURSE**

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### **ABSTRACT**

This workshop will focus on explaining how social media such as YouTube can be used to effectively motivate students in business statistics' courses. Another major emphasis of the workshop will be on using innovative ideas, such as YouTube, to improve student performance in business statistics' courses. In today's educational climate, faculty should be cognizant of how students are already familiar with social media and should consider using social media avenues as an additional teaching tool. During the workshop we will share the benefits, drawbacks, and challenges associated with using social media in business statistics. Specific examples will also be given.

### **INTRODUCTION: REASONS FOR USING YOUTUBE**

Today's students use social media for many uses. For those students, the use of what the authors refer to as social media is one of just many different methods available for learning business statistics skills. Reading a textbook or hearing a professor's lecture will always be most important, but other methods, such as YouTube, must be considered. The reality might be not the same as in the actual classroom environment (although it is sometimes close), but the use of YouTube is an excellent example of how social media can be used to improve learning. In addition, YouTube lessons will often also give students additional and practical insights in to business statistics. The emergence of the speedily evolving world of social media has also now given universities an additional interactive medium to facilitate teaching and learning. In

addition, for many students, learning business statistics in YouTube will be a unique learning experience that is both practical and applicable. Further, YouTube is also readily available and is easily accessible by both traditional and non-traditional students.

In quantitative courses such as business statistics, however, there are often concerns about whether students are receiving adequate teaching in all areas. This is especially a concern where there might be a bimodal distribution of students in the class. The workshop will show how three professors are using YouTube to enhance the quality of education offered to students taking business statistics courses and will describe the methods the professors have used to empower the students to successfully integrate social media, pedagogy, and academic outcomes.

Clayton State University (CSU) recognizes the impact of technological changes, such as social media, on students' ability to master learning outcomes in different courses. Over a decade ago, CSU became the third post-secondary institution in the country and the first in the Southeast to require laptops of all students. As a result, CSU is committed to incorporating the latest technological enhancements. Importantly, CSU has a dedicated Center for Instructional Development (CID), whose mission is to help instructors improve. While much of what the CID does is to help the faculty use high-tech innovations, the CID also teaches and encourages low-tech solutions, such as YouTube. The mission of the School of Business also explicitly states that instructors should use technologically enhanced methods of teaching to improve student performance.

One major determinant of success in learning is attention to individual needs. There are other ways to categorize student learning, but regardless of the paradigm, if there is a poor match between student learning style and instructor teaching style, the student will struggle. This effect may be worse for poorer students. One of the reasons that "A" students are "A" students is that they can cope with many different teaching styles. Weaker students may have more trouble adapting to different forms of instruction. One of the ways to deal with this challenge is to find a way to mimic the lecture when needed. Business statistics, like mathematics, seems to require some form of dynamic or progressive presentation. The use of YouTube often provides an excellent means of mimicking a lecture.

The ability to translate course content into learning should be positively related to success, as should the quantity of time that a student puts forth. Admittedly, brighter students and students with strong analytical skills should be able to earn a higher grade while spending less time than weak students. Weaker students may be able to substitute time for ability. However, since many students have multiple demands on their time, access to useful materials outside of the lecture and office hours is crucial. Social media avenues such as YouTube should thus also provide an acceptable avenue for the student. Some additional benefits of using YouTube include:

1. The use of social media such as YouTube addresses different learning styles. While the visually-oriented students don't have much trouble coping with traditional materials, the auditory learners do.
2. It gives students an alternative resource for understanding the functional areas of business statistics
3. Students can go through the material as quickly or slowly as they need. If they need to go over a particular concept several times, they can, without using a lot of the instructor's time. They can also do so whenever they want.
4. It enables the professor to better allocate time and material resources
5. The use of YouTube might give students who use it an advantage over students who do not use it.
6. The students become more technologically savvy. Surprisingly, many students have never considered using YouTube for academic purposes.
7. Some students dislike business statistics. For those students, the use of social media, such as YouTube, might make it more of a fun experience.

### **Some Examples**

Business statistics, like mathematics, is a course that requires a dynamic presentation. However, sometimes students, for several reasons, don't always receive the "dynamic presentation" in class that they need. With social media avenues such as YouTube, students can watch a presentation on a specific topic and hear what it is being said about that topic. As an example, in a short 10-minute presentation on YouTube, the student can (a) hear and see how a regression equation is developed and (b) hear examples of how the regression model is used. Since what is presented in YouTube is usually presented as it is written, this feature is especially attractive to students who struggle with business statistics and find it difficult to follow the text-only explanations in books or the professors' lectures. Instead of hearing, "I understood everything when you did it on the board, but I couldn't do it at home," the students know that they have a way to see and hear what was done as many times as they need.

We recommend the following approach when having the students use [www.YouTube.com](http://www.YouTube.com).

- 1) Determine the area where a student needs additional assistance
- 2) Have the student find relevant example(s) in YouTube
- 3) Use the YouTube examples when working applicable problems in the business statistics course
- 4) Have the print out, if possible, any lessons he/she has learned on YouTube.

The business statistics is currently divided into four distinct areas and resources are available on YouTube in each of those four areas:

Descriptive Statistics: Initially, have the students go into [www.YouTube.com](http://www.YouTube.com) and type in *descriptive statistics*. There are many outstanding short videos. One, titled *Statistics: The Average* (12 minutes, 35 seconds), should give students an excellent beginning lecture on descriptive statistics, while also showing students how they might use [www.YouTube.com](http://www.YouTube.com) to improve their knowledge in the statistics area. Please keep in mind that many of the students told the authors of the workshop that they preferred watching short [www.YouTube.com](http://www.YouTube.com) presentations of 5 to 15 minutes.

Probability: Again, there are many excellent short videos. Have the students type in either *probability* or *probability and statistics*. There are three very good short videos under Playlist titled *Probability 1* (10:30 minutes), *Probability 2* (9:54 minutes) and *Probability 3* (10:06 minutes).

Hypothesis Testing: Just have the students type in hypothesis testing. In addition to the many hypothesis testing videos available on Playlist, there are numerous other ones to which the students could refer.

Regression analysis: We recommend that the student type in Regression Analysis in YouTube. There are many examples, but good ones are Regression Analysis I (9 minutes 54 seconds) and Regression Analysis II (9 minutes 53 seconds). Both are excellent modules and remind students that they need to take advantage of Analysis TookPak in Excel.

## SUMMARY

The session should be beneficial to faculty wanting insights into how a social media area such as YouTube can effectively be used in their curriculum. Students have stated that the short sessions that they reviewed in YouTube often presented the material in a logical format that they were able to understand. The students reiterated that the professor was fine; YouTube just gave them an additional means of learning the material. Any type of learning that helps alleviate stress is helpful. YouTube appears to give the students an excellent additional opportunity (outside of the regular classroom environment) to watch a lecture, hear the explanation, and take notes. Students also indicated that they appreciated being able to hear and see the lecture. The use of YouTube will not replace the professor's lecture, but, if the professor uses it correctly, it might give the professor more class time to work problems. We heartedly recommend that faculty teaching business statistics try using YouTube and other social media to enhance the learning outcomes of their students.

## **An Innovative Way to Teach Sampling and Confidence Intervals Using EXCEL**

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### **ABSTRACT**

Teaching a required course in statistics is a challenging task. The concepts of sampling and confidence intervals pose an uphill battle for many students. The author offers an innovative approach for teaching these concepts using EXCEL. The paper includes helpful details of various issued commands and several examples of graphical output.

### **INTRODUCTION**

Teaching business statistics concepts to undergraduate students in a college of business is a challenge. Business schools generally include business statistics in their common body of knowledge (CBOK) coursework, making it a required course. The “quant phobia” or fear of numbers that grips many students manifests itself abundantly in statistics. In particular, one of the key topics that students tend to grapple unsuccessfully with is sampling and confidence intervals. It is not uncommon to find students who excel in basic statistics and probability but fail miserably in their understanding and implementation of sampling and confidence intervals. Some don’t like or understand these concepts, some feel that the terms are convoluted and confusing, others find little practical use in them. The cryptic way in which some text books broach the topic offers them little comfort. This paper explores an innovative way to teach sampling using EXCEL. The active learning paradigm presented can be applied to most statistical topics.

To facilitate a conceptual understanding of sampling and confidence intervals, a 7-step action-oriented approach has been proposed in which students create a normal population, draw various size samples from it, analyze and interpret the results, and make graphical presentation of their results. The specific

steps involved as follows:

1. Generate the population, consisting of 1000 values representing weekly grocery expenditures, using the RAND and NORMINV commands
2. Using PIVOT TABLES create a frequency distribution and plot for the population data (Figure 1)
3. Generate 100 samples, each of size 20 from the population using the RANDBETWEEN and VLOOKUP commands
4. Using PIVOT TABLES create a frequency distribution and plot for the sampling distribution based on the sample data (Figure 2)
5. Estimate the 95% confidence interval for the mean for each of the 100 samples of size 20 and plot the lower and upper limit points on a scatter plot (Figure 3)
6. Repeat 3, 4, and 5 for 100 samples of size 80 and plot the lower and upper limit points on a scatter plot
7. Compare the confidence interval widths for #5 and #6 (Figure 4)

Creating the Population Students study the concept of population in sampling. It represents all data points of interest in the study. For a retailer, it would include every potential customer. Students are taught that taking repeated samples from a normal population produces a sampling distribution that is normal regardless of the sample size. To make the sampling distribution we draw samples repeatedly from the population and keep track of their respective means. While some students are intrigued by this mysterious “sampling” distribution, several are puzzled, and go through the pretense of understanding the subject matter. They often have a hard time buying the statement that the sampling distribution will be normal regardless of sample size if the underlying population is normal. They are seldom asked to verify this first hand with actual data. In fact, most instructors resist attempting such an exercise during class fearing the time commitment it may entail.

EXCEL offers two helpful functions that can help create a population. The functions are RAND and NORMINV. The RAND function generates a random number between 0 and 1. Statistics students get intimately familiar with the bell-shaped NORMAL distribution. They learn that each normal distribution is characterized by its mean,  $\mu$ , and standard deviation,  $\sigma$ . For a random variable X following the normal distribution with a given mean and standard deviation, students routinely compute the probability, “p” of the random variable being less than a particular value “x,” i.e.  $p = P(X \leq x)$ . The NORMINV function

does the reverse of that, for a random variable  $X$  following the normal distribution with a particular mean and standard deviation, and a given probability, “ $p$ ”, it computes the value of “ $x$ ” for which  $P[X \leq x | N(\mu, \sigma)] = p$ . NORMINV takes three parameters to execute –  $p$ ,  $\mu$ , and  $\sigma$ .

Combining the functionalities of NORMINV and RAND function makes it easy to generate a population that is normally distributed. The idea is simple, instead of feeding “ $p$ ” values to the NORMINV function, the RAND function is inserted in its place, which gives us “ $x$ ” values that belong to the normal distribution for a given  $\mu$  and  $\sigma$ . By generating the numbers 1 thru 1000 in column A, and simply copying and pasting the end result of the NORMSINV(RAND(),  $\mu$ ,  $\sigma$ ) down the column B by double clicking the file handle, one can generate the desired number (in our case, 1000) values that constitute the population. To generate the numbers 1 thru 1000, one only needs to type the first three numbers, select them all, and then drag the file handle all the way down until EXCEL displays the number 1000. The file handle refers to the dark blob that appears at the bottom right of the selected cells in EXCEL.

### Pivot Table and Chart

It is of interest to conclusively know that the 1000 numbers we generated in our population do follow the normal distribution. A simple PIVOT TABLE plot can verify that. The procedure for doing this is as follows. Let’s give our columns A and B the headings “Obs.” and “Value” respectively. From the Insert menu, select “Pivot Table.” Identify the 1000 values in column B when it asks for the table or data to analyze. To do this simply click the first value in column B, and then keeping the SHIFT and END keys pressed, press the  $\downarrow$  key. In choosing the site to display the PIVOT TABLE, simply check the “Existing Worksheet” radio button.

Check the “Value” box from the Pivot Table Field List. Drag it to the *Row Labels*. Now drag it again, this time to the  $\Sigma$  values. The display under  $\Sigma$  values should read “Sum of Value.” Click the lower arrow

displayed at end of the “Sum of Value” display and check on “Value Field Settings” and select “count” from the options listed. The “Sum of Value” display will now change to “Count of Value.” As a result of our actions, the spreadsheet will display two additional columns titled “Row Labels” and “Count of Value.” Select any entry under the “Row Labels” and do a right-click of your mouse. Select “Group” from the list of options. The minimum (“Starting at”) and maximum (“Ending at”) values of the “Row Labels” column will be now displayed. Change these values to round numbers that include the range of values in the column. The size of the histogram intervals can be set by setting the “By” parameter. An interval frequency distribution will now be displayed. By clicking on the “PivotChart” icon under “Pivot Table Tools” and simply accepting the defaults, the display changes to a visually appealing normally distributed histogram plot. Students have voiced loud approval of this visual display. Figure 1 demonstrates the PIVOT CHART. It’s worth the effort!

#### Generating 100 Samples of Size 20

The spreadsheet currently consists of two columns. The first column is entitled “Obs.” and bears the numbers 1 thru 1000 under the title. The second column contains the weekly grocery expenditures for each sample under the title “Value.” To generate a random sample of 20, we add another column called Sample1. To determine which 20 values out of the available 1000 should be included in the sample, the RANDBETWEEN function is used.

RANDBETWEEN function takes on two integer parameters Bottom and Top, and generates random numbers between Bottom and Top. Since we have 1000 samples, by making Bottom=1 and Top=1000, we can get RANDBETWEEN(1, 1000) to generate for us the observation number to include in our sample. Copying and pasting it 20 times will generate 20 such numbers. That is our first sample. By simply selecting the entire sample 1 data and dragging it across 99 more columns, 100 samples can be created.



Since the samples have random data, it will keep changing with every operation involving them, (e.g. copying and pasting). To freeze the data, after it has been generated, simply select the entire data set, do CONTROL-C (for copy), and then do a right-click on the mouse, select “Paste special” and then choose “values” and hit ENTER.

The RANDBETWEEN function results give us the position of each of the data element to include in the sample. To obtain the actual values associated with them, the EXCEL function VLOOKUP is used. The VLOOKUP function has three parameters of interest to us: lookup-value, table-array, and column index number. The look-up value is the number generated by RANDBETWEEN function. The table array would be the 1000 values of columns A and B together. The column index would be 2, since we need corresponding numbers from B, which is the second column. The table array addresses are globalized (i.e. \$ signs are put before the row and column addresses) since their values will not change when the VLOOKUP function is copied repeatedly to obtain all sample values. These values can be placed just below the RANDBETWEEN values, leaving a space gap for clarity sake.

The 20 instances of VLOOKUP function can be selected together and copied across to generate all 100 samples of size 20. Mean and standard deviation for each sample can be computed using the AVERAGE and STDEV functions and placed just below the sample VLOOKUP values, leaving a space or two for clarity.

### Sampling With and Without Replacement

It is possible to get duplicate observation numbers in a sample. This makes it possible to teach two types of sampling – with and without replacement. In the “without replacement” case all values will be unique, while in the “with replacement” case duplicates will be included. To get the “without replacement” case, simply select the sample data, select the Remove Duplicates option under Data from

the main menu and let EXCEL remove the duplicates. The removed duplicates can be replaced by new fresh values as before, and the duplicate check repeated to ensure unique values. An alternate, easier approach is to generate a few extra values to compensate for the potential duplicates, and trim their number to the desired sample size after removing duplicates.

#### Pivot Table and Chart for Sampling Distribution

The procedure used for this is identical to the one used for generating the PIVOT CHART for the entire population. Students are amazed to see the normal or near-normal characteristics in the Sampling distribution histogram. Figure 2 illustrates the sampling distribution.

#### Creating 95% Confidence Intervals for Each Sample

Since the data for each sample is located in a column, and the mean and standard deviation values are known. It is quite easy to obtain the confidence interval values. Since we know that the lower and upper limit are given by  $\bar{\theta} \pm t_{(\alpha/2, n-1)} s/\sqrt{n}$  where  $\bar{\theta}$  is the sample mean,  $s$  is the sample standard deviation,  $n$  is the sample size, and  $t_{(\alpha/2, n-1)}$  is the t-value, obtained in EXCEL by using the TINV function with  $\alpha/2$  equal to 0.025, and  $n-1$  equal to 19. Plotting the lower and upper limits of all 100 samples on a scatter plot with joined lines makes for an interesting figure with great pedagogical value. It helps in explaining the meaning of confidence intervals. A 95% confidence interval (L, U) for the population mean  $\mu$ , based on one sample's data may be interpret in the following manner. If we repeatedly sampled the underlying population and constructed (L, U) type intervals for all of them, then 95% of them would contain the value  $\mu$ . The visual impact of figure 3 on the students is immeasurable.

### Repeating the Exercise for Sample Size of 80

There is no substantive change in the methodology for generating and analyzing 100 samples of size 80 from the population data. The PIVOT TABLE and PIVOT CHART for the sampling distribution histogram can be made as before. The visual impact of the much narrower sampling distribution histogram, shown in figure 4, presents a great teaching moment. Students can succinctly visualize that taking larger sample sizes will result in narrower sampling distribution, which in turn will make for more precise confidence intervals.

It is also helpful to quantitatively illustrate the fact that the width of the 95% confidence interval (L, U), given by  $w = U - L$ , varies inversely with the square root of the sample size, or  $w = 2 t_{(\alpha/2, n-1)} s/\sqrt{n}$ . Since we have 100 samples each of sizes 20 and 80, we can show that the average confidence interval width for a sample of size 80 is almost one-half of that of sample of size 20.

### SUMMARY

The student response to this approach has been quite gratifying. It is heartening to see the students actually excited while performing statistical tasks! EXCEL takes the boredom out of repetitious work by offering convenient copying and pasting strategies. The visual appeal of PIVOT TABLES and PIVOT CHARTS is addictive and pedagogically helpful. Every student generated different samples but they all got basically the same results. It explained to them the power of random sampling, and the little value-added that results from sampling repeatedly. The exercise aided the students in better understanding the concepts of sampling and confidence intervals. The active learning paradigm presented in this paper can be applied to most topics covered in statistics. The current example can be extended to include additional topics like regression and hypothesis testing.

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Generate Population Distribution values using  
**NORMINV(rand(),90,20)**

Typical values  
 (2000 of them altogether) :

- 87.96
- 116.67
- 85.48
- 104.99
- 110.42
- 115.63
- 97.07
- 112.03
- 102.59
- 107.42
- 85.04
- 88.43
- 115.93

<u>POPULATION</u> Interval	<u>DISTRIBUTION</u> Frequency
-------------------------------	----------------------------------

20-30	2
30-40	8
40-50	28
50-60	82
60-70	159
70-80	318
80-90	396
90-100	371
100-110	302
110-120	209
120-130	79
130-140	34
140-150	11
150-160	1

(Pasted from PIVOT TABLE)

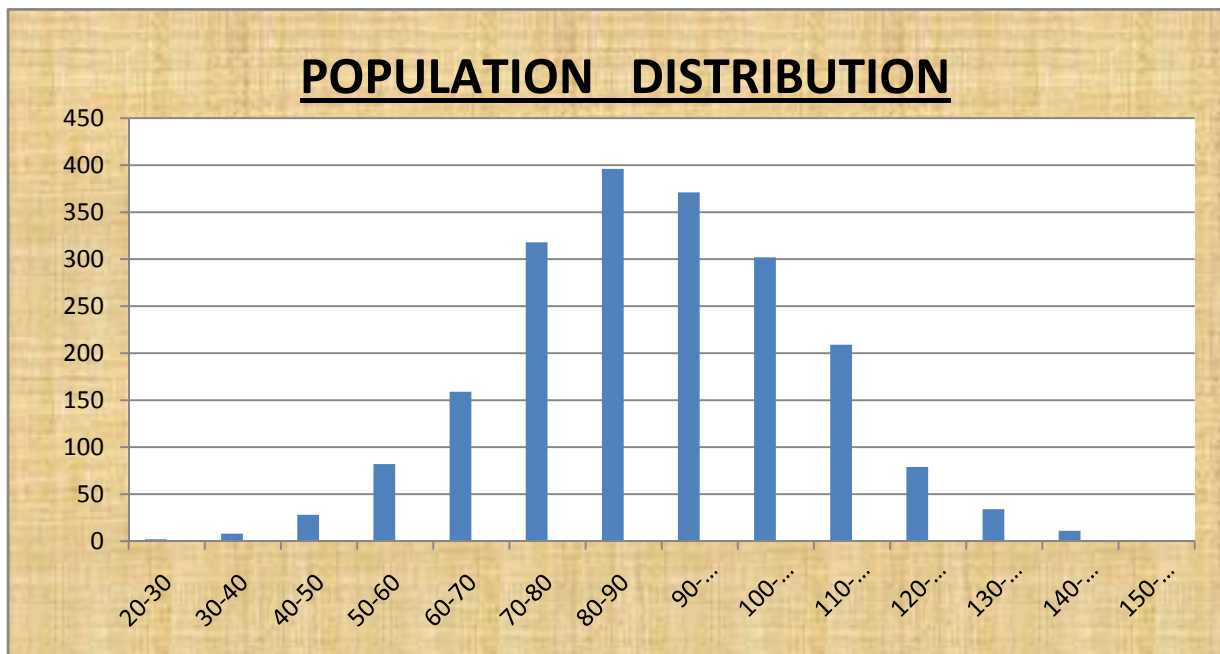


Figure 1: The Population Distribution Histogram

Generate 100 samples using  
 RANDBETWEEN(1,2000) and  
 VLOOKUP commands

Typical values  
 (100 samples of size 20 overall):

96.55	72.66	124.79
96.65	113.12	78.75
...	...	...
76.86	55.88	108.49
69.14	80.78	92.86

88.44	90.61	87.87
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<u>SAMPLING</u> Interval	<u>DISTRIBUTION</u> Frequency
-----------------------------	----------------------------------

75-77.5	1
80-82.5	4
82.5-85	7
85-87.5	12
87.5-90	24
90-92.5	24
92.5-95	14
95-97.5	10
97.5-100	1
100-102.5	2
102.5-105	1

(Pasted from PIVOT TABLE)

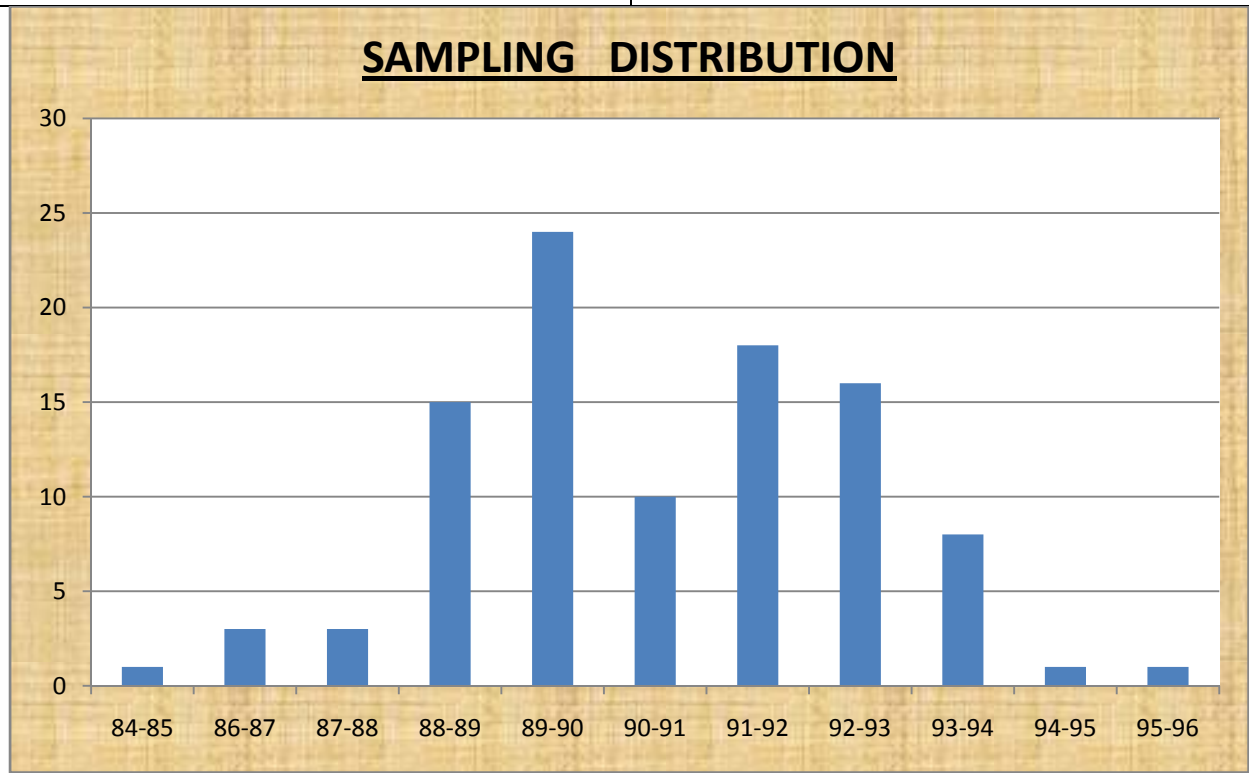


Figure 2: The Sampling Distribution Histogram

Generate confidence intervals for the population mean based on each sample of size=20 data (100 samples in all) using:

$$\text{MEAN} - \text{INV}(0.025,19) * \text{STDEV} / \text{SQRT}(19)$$

MEAN = sample mean

STDEV = sample standard deviation

Typical Values  
(100 sets in all)

Sample	LCL	UCL
1	76.7567	98.2733
2	79.51091	104.4511
3	79.47532	96.44868
4	70.63981	91.25919
5	67.21427	91.26773
6	77.49007	99.07093
7	74.47348	98.09952
8	79.56149	96.08551
...	...	...
98	86.65328	106.2957
99	76.01546	95.26154
100	86.17844	107.5126

### CONFIDENCE INTERVALS

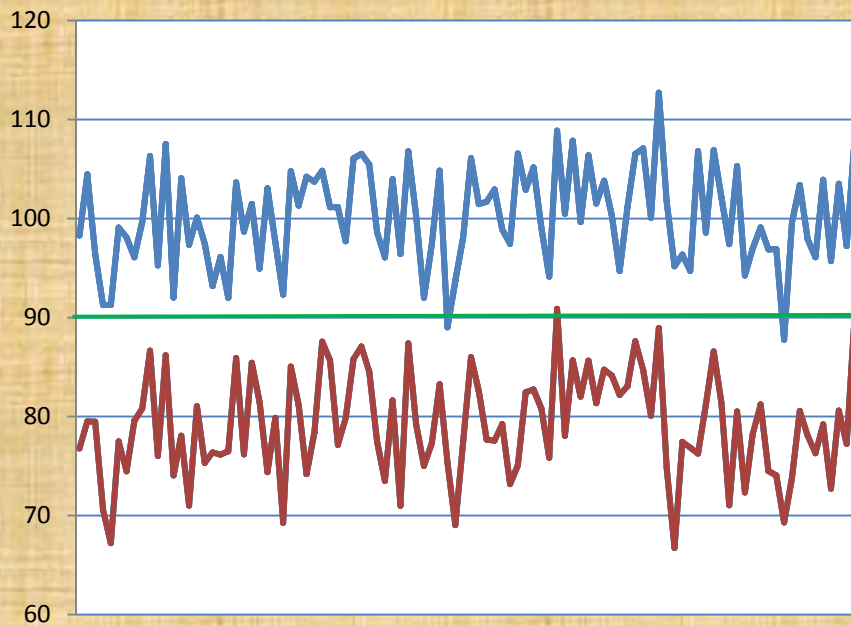
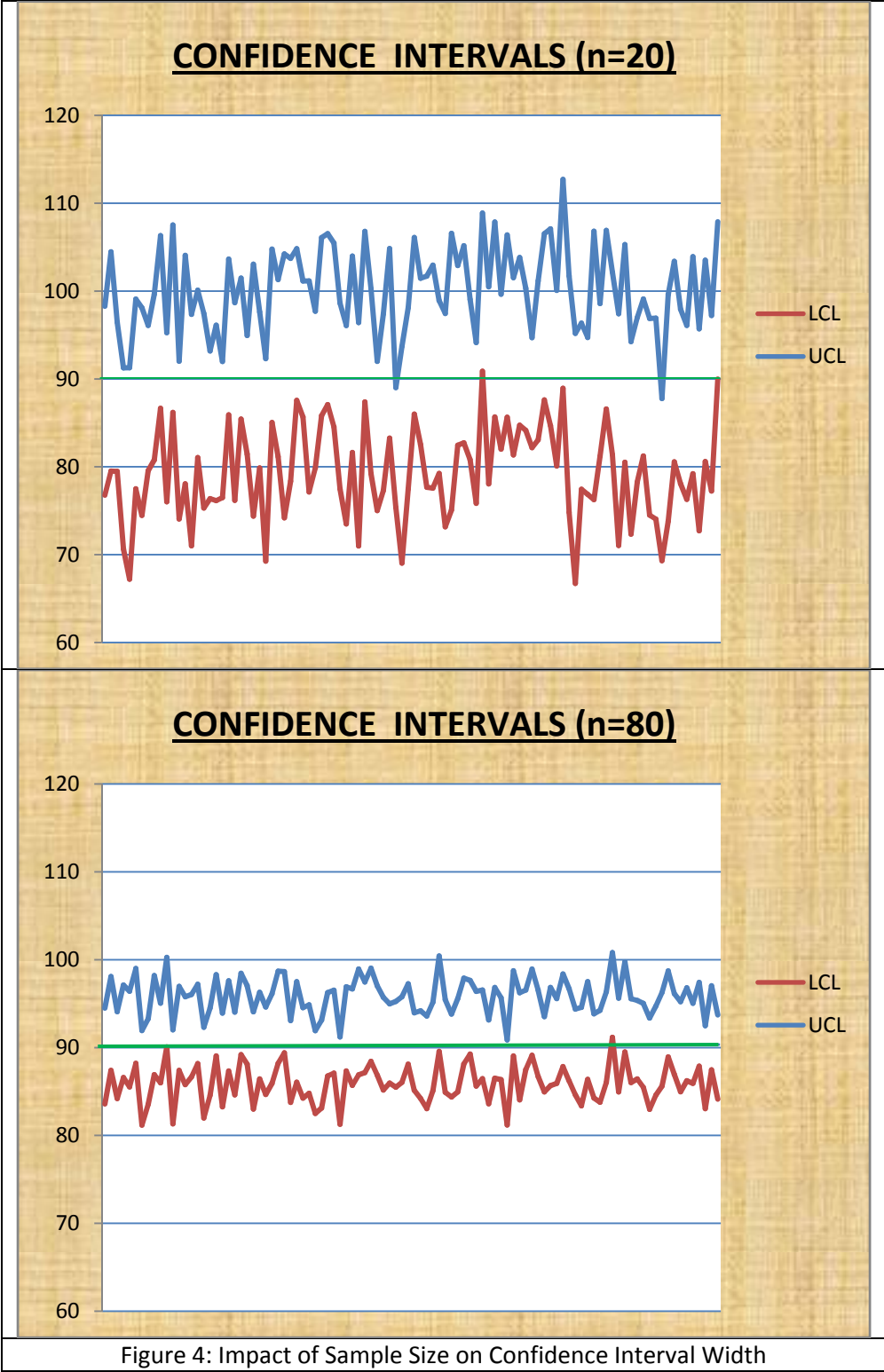


Figure 3: 95% Confidence Intervals





# **A STUDENT TERM PAPER EVALUATING STATIC VERSUS DYNAMIC BUY AND SELL SIGNALS IN THE STOCK MARKET**

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## **ABSTRACT**

This is a follow-up paper[5] that expands past research of the methodology and pedagogy of a term paper used to grab student interest and throw them into the world of predicting the price of a stock, when to buy and sell that stock, and maximizing future wealth using quantitative buy and sell signals. The goal is to forecast the expected price of a stock over a planning horizon of 65 weeks using a time series analysis model. Three timely examples for four stocks are presented to aid in the development of the case using a variety of buy and sell trigger points. Topics: time series, Bollinger Bands, and basic accounting. Track: Experiential Learning.

## **INTRODUCTION**

During the first class of the term students are presented with the expectation that they will not collect any social security. Either the social security fund will be fully depleted by the time they retire or they will be means tested out of the possibility of receiving any social security because of their college degrees and expectation of good jobs and comfortable incomes.

It is further stated that since this is “their lot in life”, they must have a method of making enough money to retire comfortably without any expectation of government help. They could be professional athletes, invent a new computer language, or learn to “slow trade” in the stock market. There are at minimum three methods of using the stock market. The most used by “normal” people is to invest in stocks--buy a stock or many stocks and keep them “forever.” The other end of the spectrum is “day-trading.” This method is for the experts (or crazies) who buy and sell the same stock at least two times per day. This has an official name from the Securities and Exchange Commission--”patterned day trader.” The third method is “slow trading” which includes buying and selling of the same stock over a number of weeks or months totaling as few as two or as many as ten times over a one year period. This method takes advantage of stocks “highs” and “lows.”

Few expect to be the next Brett Farve or Bill Gates. Therefore they are left with the exciting prospect of making money in the stock market--and not by merely investing money from every paycheck. Learning to slow-trade stocks is exciting and extremely interesting to students in the 21st century and they jump at the opportunity to learn the ropes.

## EXTENSION BEYOND THE FIRST PAPER

This follow-up paper has been spawned for two reasons. First, after all students had turned in their term papers, the results were tabulated. Which stock returned the most money after a 65 week simulation of slow trading? The class divided 40 stocks, with two or three reports for each stock. Out of the 40 stocks, total dollar value at the end of the 65 week trading horizon for a given stock was identical for only one of the forty stocks evaluated. Two quick conclusions: a) students did not cheat and compare results; and b) there were plenty of mathematical or accounting errors in the results. These results were very bothersome. The second reason to have a follow-up paper is that the process of finding the best buy/sell triggers for a particular stock shows great promise to slow traders. One student became “overly” interested in the process and asked to be part of a more extended research project.

In the first paper, the “future research” portion lists so many possible “next steps.” We tried to tackle a new meaty project, but one that could be accomplished in a short time. We settled on evaluating four stocks rather than 40. The four stocks are stocks that one author trades on a daily basis. We decided on three time frames. The first two would be static simulations (3/30/07 through 6/20/08--the time frame from the first paper and 3/21/08-6/19/09--the time frame ending at the beginning of the writing of this paper and the beginning of the dynamic time frame). The third time frame would start on June 26, 2009 and continue through November 27, 2009--the day we needed closure to get the paper submitted.

It was important to get the numbers--dollars and shares--correct! Yet the two of us did not have the time to do all 40 stocks. It was also important to look at the dynamic aspect of slow trading. An interesting question is, “Can you sit and wait as the stock price moves closer and closer to your buy/sell trigger?” The impatience of traders is well known and missing the buy/sell trigger by a few pennies would really upset any trader. Would the slow trader be so tempted to “push the button?” Although the buy and sell triggers are “set,” it is most interesting to see if the stock trader would buy sooner or sell sooner than the triggers because of natural greed. This paper tries to explore that very natural phenomenon.

### FOUR STOCKS IN THIS RESEARCH

The four stocks chosen for this paper are:

- |     |                        |      |
|-----|------------------------|------|
| 1.  | Ameriprise             | AMP  |
| 2.. | Charles Schwab & Co.   | SCHW |
| 3.  | Kohl’s                 | KSS  |
| 4.  | McDonald’s Corporation | MCD  |

All are solid companies although Ameriprise is a spin off of the brokerage arm of American Express with a short life so far, but AXP has a long, long history.

### BACKGROUND

John Bollinger developed the concept of “Bollinger Bands” in the early 1980’s as a means to have a relative definition of a “high price” and “low price” of a stock or really a “too high price”

and a “too low price” of a stock and thus is developed the concept of a “buy” and “sell” signals using the Bollinger Band technique[3]. Bollinger developed his technique using a simple moving average over time and with the addition of the use of a 95% confidence interval quantified the “too high” and “too low” price of a stock. Bollinger showed that volatility is dynamic and not static and thus the width of the Bollinger Band changes with the volatility of the stock price over time. He has become wealthy and is well spoken around the world from this simplistic beginning.

The model used in this research is a Time Series Model with Seasonal Indices (13 weekly indices) to forecast the price of a stock. Every 13 weeks a company releases earnings per share information and thus it is possible that there is a 13 week seasonal pattern. The confidence intervals are determined by using a time series decomposition model to determine a forecast and then the end points are determined by adding and subtracting different numbers of standard deviations, two (Z-score = 1.96) for example, to create different interval widths, a 95% confidence interval for example. Using different values for the Z-score create the interesting research project for this case.

### **RESEARCH SETTING**

The goal of the project is to maximize the wealth over each of two 65 week planning horizons and the shorter dynamic horizon. Each trader starts with \$100,000. Buy and Sell triggers are set by the use of a time series model with trend and seasonal indices and the use of the “Bollinger Bands” as the trigger points. Buy and Sell triggers are set by the use six different Z-score values--the width of the confidence interval. The overall goal is to determine what level of Z-score (width of the confidence interval) will maximize the wealth of the trader.

Ideally, the planning horizon of 65 weeks would be forecasted individually each week using the following process: (dynamic, third time frame)

- 1) forecasting for the first week into the future,
- 2) setting the buy/sell triggers,
- 3) buying or selling the stock if the trigger is crossed, and finally,
- 4) updating the data set by adding the newest or latest week of actual price data and removing the oldest week of data.

This would continue for the shorter 23 week trading window.

The two static simulations are much easier to execute in a programming sense. The researcher forecasts for 65 weeks into the future from the first week (3/30/07 and 3/21/08). The trader then determines when the Bollinger Band or buy/sell triggers are penetrated. A buy or sell occurs at that point. The trader proceeds through the 65 weeks ending June 20, 2008 and June 19, 2009.

### **SPECIAL CONSIDERATIONS**

- Six level of Z-scores are used: 2.0, 1.75, 1.5, 1.25, 1.0, and 0.75.
- Trade Commission: \$7.00 to buy the stock (price at Scottrade).  
\$8.95 to sell the stock (price at Schwab).

[Faculty member uses both companies and talks about both in class.]

- There is no SEC tax paid. There is no interest paid on cash levels in account.
- You can buy only whole shares.
- You buy when the price of the stock crosses the lower Bollinger Band (BB).
- You sell when the price of the stock crosses the upper Bollinger Band (BB).
- Although the stock may go lower (or higher) than the respective Bollinger Band (BB) trigger point, you already bought (or sold) the stock.

## **HOW TO EXECUTE BUYS AND SELLS**

Start: The trader may buy stock at the closing price of the first week or may wait until the stock price hits the lower BB. This seems a little unrealistic because the trader is going to make that first decision (what to do during week #1) by looking into a future that theoretically has not happened. However, you need to start somewhere and this is a method of making the simulation “fair.” If the stock is going up from the first week toward the upper BB, the trader would want to buy at the close of the first week to take advantage of the increasing price. If the stock is heading down toward the lower BB, the trader would want to wait until the stock price hits the lower BB.

Future buys and sells: If the stock price hits the upper BB during the week, using the high of the week, and you own the stock, you would sell all of your shares at the value of the upper BB. If the stock continues to a higher value, you already sold it (sorry). If the stock price hits the lower BB during the week, using the low of the week, and you did not own the stock, you would buy to the limit of your available cash (remembering that you must buy whole shares and have \$7.00 to pay the commission). You buy at the value of the lower BB. If the stock continues to go lower, you already own it (sorry).

How to determine the exact price of the BB’s: The trader must forecast the price of the stock for each week of the 65 week planning horizon. Remembering that this is a static model, not a dynamic model, makes this process very easy. The forecast is derived by using a Time Series model with 65 weeks of closing prices starting on Friday, March 30, 2007 and March 21, 2008, and ending Friday, June 28, 2008 and June 19, 2009. Exhibit One displays the Excel graph for the sample stock--Charles Schwab and Company, ticker symbol: SCHW, used for sample purposes in this paper and slightly different 65 week data base.

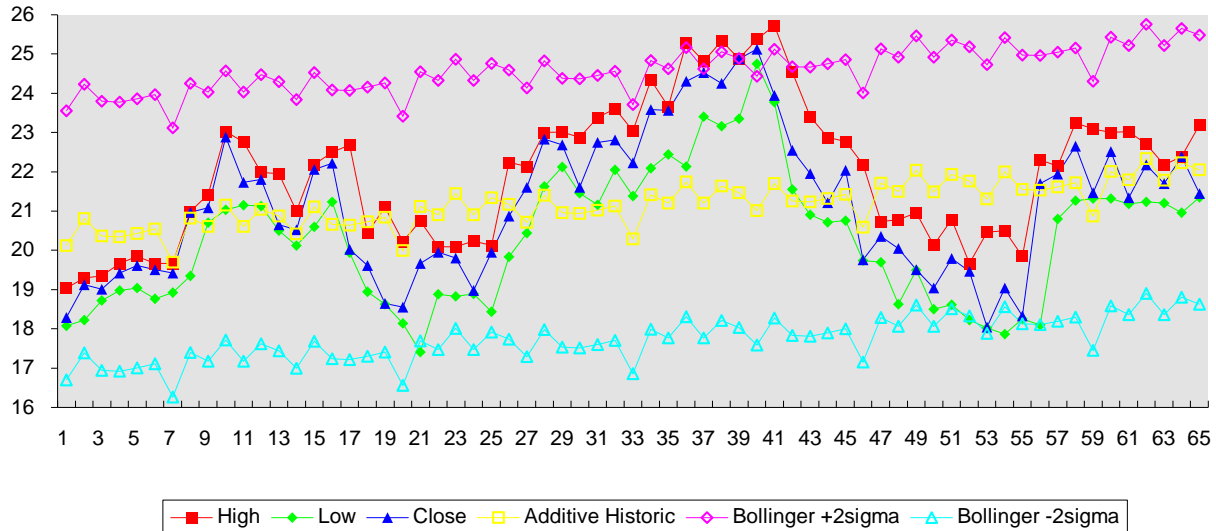
Noting the legend at the bottom of the plot, the additive model is used in this example because of the three seasonal models presented, the additive has the lowest standard deviation. The upper and lower Bollinger Bands show the sell and buy triggers. To execute a trade, the graph is used as an estimate. The template contains that actual numeric value of the upper and lower Bollinger Band and these numbers are used to compare with the respective stock price high (for a sell trigger) or stock price low (for a buy trigger).

Table One presents an accounting chart that lists the buys and sells that are made during the 65 weeks of the planning horizon for Schwab stock using the triggers of a Z-score of plus and minus 2.0 (classic 95% confidence interval). Stock purchases are made in week #21 and #52 (stock low for the week crossing the lower Bollinger Band). The only sell took place in week #36

(stock high for the week crossing the upper Bollinger Band). At the end of the 65th week, the stock is still owned by the team and the value of the stock at the closing price on June 20, 2008 is added to the small cash in the account.

### EXHIBIT ONE

Weekly HILOCL+F(t)+AddBB



### TABLE ONE

Week#	BuyPr	#shares	\$Cost	SellPr	#Shares	\$Proceed	\$cash
0							100000
21	17.69	5651	99973.19				26.81
36				25.16	5651	142170.21	142197.02
52	18.33	7757	142192.81				4.21
65	21.45	7757					166391.86

Thus after starting with \$100,000 and using the classic Bollinger Bands as buy and sell triggers, the trader gained slightly over 66% in 65 weeks of “slow trading.” Before moving to the next simulation, it is critical to look at the “control investment.” The trader could buy the stock at the close of week #1 and simply keep the stock the entire 65 weeks--a true investment--and calculate the net value of the fund at the end of the 65th week. With a price of \$18.29, 5467 shares would be purchased at a cost (plus commission) of \$99,998.43. At the end of 65 weeks of investing (really, sitting still and doing nothing) the stock would be valued at \$21.45 per share for a total of \$117,268.72 (adding in the cash balance of \$1.57). It should be noted that over 65 weeks the stock price increased 17%. That is not a bad return. However, the slow trading method performed much better.

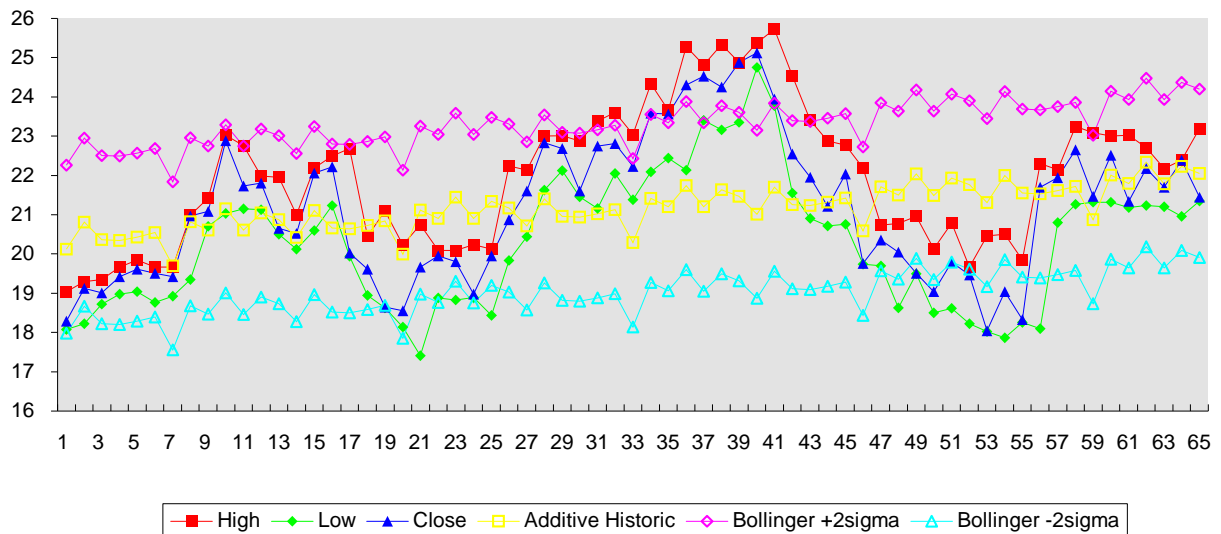
Each of the other five Z-scores are simulated in the same manner as just described. Included in this paper are the accounting sheet (Table Two) and the graph (Exhibit Two) for a Z-score of 1.25.

TABLE TWO

Week#	BuyPr	#shares	\$Cost	SellPr	#Shares	\$Proceed	\$cash
0							100000
2	18.66	5358	99987.28				12.72
11				22.74	5358	121831.97	121844.69
19	18.69	6518	121828.42				16.27
31				23.16	6518	150947.93	150964.2
48	19.35	7801	150956.35				7.85
59				23.01	7801	179492.06	179499.91
65							179499.91

EXHIBIT TWO

Weekly HILOCL+F(t)+AddBB



Looking at the graph in Exhibit Two and comparing it to the graph in Table One, it is easy to see the difference. The Bollinger Bands are “pinched” toward the mean with the Z-score of 1.25. Thus as the stock price increases or decreases, it will hit the trigger points sooner and the purchase or sale will occur more often. This is both good and bad. There is a chance of more gains with more trades. However, it is disappointing when the buy is made and the stock price continues to go higher, sometimes much higher. The other situation is also as frustrating. The stock price crosses the Z-score of -1.25 trigger and the purchase is made. However, it is quite possible that the stock price continues to go down, sometimes a lot more. It is important to remember the theory of Normal Curves. There is only a 2 1/2% chance that the value of the

dependent variable will be above the upper Bollinger Band and only a 2 1/2% probability that the stock price will be below the lower Bollinger Band at the classic Z-score of 2.0.

When a smaller Z-score is used, the probability that the stock prices goes above and continues to go higher than the  $1.25\sigma$  trigger point is quite high. So, although the executions may occur more often, they miss the best timing of the buy or sell. Because of these conflicting happenings, a mathematical equation cannot be used to determine the “best” Z-score to maximize wealth. Table Three presents a summary of the six Z-scores used in the case.

TABLE THREE

Z-score	# of buys	# of sells	\$wealth
2.0	2	1	\$166,391.88
1.75	2	1	\$156,015.40
1.50	2	1	\$141995.14
1.25	3	3	\$179,499.91
1.00	3	3	\$167289.91
0.75	3	3	\$151707.13

**DYNAMIC VERSUS STATIC MODEL--THE DIFFERENCES**

Not only was the method of simulation different, the starting solution was also different. The two static simulations were started with \$100,000 cash as stated before. the third, dynamic simulation, started the week after the second simulation ended and started with the number of shares and or dollars from the end of the second simulation, June 19, 2009.

The results from the three time frames for the four stocks and the six Z-scores are presented in Table Four.

TABLE FOUR

STOCK: AMP

Time Frame	3/30/07-6/20/08			3/21/08-6/19/09			6/26/09-11/27/09		
Z-score	#buys	#sells	\$wealth	#buys	#sells	\$wealth	#buys	#sells	\$wealth
0.75	5	4	\$185,349	2	2	\$206,297	1	1	\$345,795
1.00	4	3	\$174,228	1	1	\$162,791	1	1	\$272,857
1.25	3	2	\$162,337	1	1	\$162,791	0	0	\$162,791
1.50	3	2	\$164,420	1	1	\$180,717	0	0	\$180,717
1.75	3	2	\$171,837	1	1	\$180,717	0	0	\$180,717
2.00	2	1	\$132,635	1	0	\$145,352	0	0	\$224,383

STOCK: SCHW

Time Frame	3/30/07-6/20/08			3/21/08-6/19/09			6/26/09-11/27/09		
Z-score	#buys	#sells	\$wealth	#buys	#sells	\$wealth	#buys	#sells	\$wealth
0.75	4	3	\$141,461	2	2	\$146,009	1	1	\$178,522
1.00	3	2	\$155,477	2	2	\$154,098	1	1	\$182,734
1.25	3	2	\$168,863	2	2	\$162,879	1	1	\$193,145
1.50	3	2	\$167,563	2	1	\$157,700	0	1	\$195,619
1.75	2	1	\$146,011	2	1	\$201,787	0	1	\$280,147
2.00	2	1	\$151,649	1	0	\$146,752	0	0	\$145,278

STOCK: KSS

Time Frame	3/30/07-6/20/08			3/21/08-6/19/09			6/26/09-11/27/09		
Z-score	#buys	#sells	\$wealth	#buys	#sells	\$wealth	#buys	#sells	\$w
0.75	4	3	\$130,999	3	3	\$255,787	1	1	\$324,309
1.00	3	2	\$106,641	1	1	\$154,547	1	1	\$193,683
1.25	2	1	\$115,996	1	1	\$153,676	1	1	\$192,597
1.50	1	1	\$116,350	1	1	\$153,676	1	1	\$224,815
1.75	1	1	\$117,552	1	0	\$161,377	0	0	\$200,887
2.00	1	0	\$59,094	1	0	\$161,377	0	0	\$200,887

STOCK: MCD

Time Frame	3/30/07-6/20/08			3/21/08-6/19/09			6/26/09-11/27/09		
Z-score	#buys	#sells	\$wealth	#buys	#sells	\$wealth	#buys	#sells	\$wealth
0.75	3	2	\$142,088	3	3	\$173,706	2	2	\$197,535
1.00	3	2	\$148,318	3	3	\$182,924	2	2	\$214,390
1.25	3	2	\$152,424	3	3	\$197,957	1	1	\$219,434
1.50	2	1	\$144,389	3	2	\$192,143	0	1	\$222,191
1.75	2	1	\$151,846	2	1	\$158,149	0	1	\$182,874
2.00	1	0	\$110,219	2	1	\$161,471	0	1	\$198,536

**SUMMARY OF THE RESULTS**

The results yield no ability to make a conclusion about which Z-score is the best. The “winning” Z-score is different for different stocks. Possibly if we had simulated all 40 stocks, a “best” Z-score may have emerged. However, this is not the case. The dollar wealth of Kohl’s is impressive, but the variability of that stock is withering and a strong stomach is required to trade Kohl’s.



## CONCLUSION

The topic is extremely interesting and important to future wealth of people who should not expect to receive Social Security. However, we are very disappointed in our results. We did not want to "bite way more than we could chew." However, we bit off so little that we have nothing new to present. We only looked at four stocks. We need to look at all 40 again. We looked at only six Z-scores and need to look at 100 different variations. We did look at a dynamic model and this did give us pause. With a week to sit and look at the stock move closer and closer to the trigger point, it became more difficult to not just pull the trigger. Yet, we really could not experience the "real" deal because we did not use real money. This leads to the very large amount of possible future research.

## FUTURE RESEARCH

The possibilities for future research are extensive. Below is a partial list of some of the future topics and questions to be researched.

- 1) Compare the wealth gained using a database of 40 different stocks.
- 2) What level of Z-score is the best? Six z-scores are used again in this research. Looking at wealth results from a group of Z- scores from 0.50 to 2.50 by 0.01 is more informative.
- 3) We did look at both a static model and a dynamic model. However, the dynamic model was very limited and we did not look at using real money. It is difficult to draw conclusions from such a limited time horizon.
- 4) Since Kohl's, for example, showed great wealth increase when using a small Z-score and thus trading many times, would it be possible to apply this same simulation to a daily time frame instead of a weekly time frame? We could possibly be looking at trading each day or at least over a few days, thus making it possible to trade on a smaller movement of the stock.

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## **Critical Success Factors for Integrating a Program of Service-Learning into a School of Computer Science and Information Systems**

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Service-learning continues to be developed as a discipline in the curricula of institutions. The learning engages professors and students in civic projects that enable community non-profit organizations in generally practical results. More than half of higher level institutions in the country have required service-learning in their curricula, and the number is increasing as institutions react to the goals of *Service Nation* initiated by President Barack Obama and the late Senator Edward Kennedy in 2009. In this workshop, the presenter, who is from a leading school of computer science and information systems in a major city in the United States, demonstrates diverse practices of service-learning in a number of courses, emphasizing solutions of technology, which he has initiated since 2003. The courses, and especially the projects in the courses taught by him and other professors in the school, are helping non-profit organizations on special systems which are taking immediate advantage of 21<sup>st</sup> century technology. This workshop introduces best-of-class pedagogy in community service-learning and information systems technologies at one of the pioneer institutions in service-learning in the United States.

The focus of the workshop is to educate members of the Southeast Decision Sciences Institute (SEDSI) on a number of popular projects that seamlessly include technology and service-learning in the computer science and information systems curriculum of their university. The projects introduced in the workshop are of agile methodologies of community customized social and technical processes that integrate individuals of communities with developmental and intellectual disabilities, counselor and managerial staff of non-profit organizations, and undergraduate students of their university, in “person-centered planning” productivity and self-improvement solutions of technology. Examples of the projects include multimedia, robotic, speech, social networking, virtual reality and related Web systems, for a number of non-profit organizations in the neighborhoods of their university. This workshop is focused on the benefits and the outcomes of the projects for students in the courses; the benefits and the outcomes of the projects for the individuals with disabilities and the staff of the non-profit organizations; and the benefits for professors in the outcomes of presentable and publishable research frequently generated as a result of the projects.

This focus of the workshop on the non-profit organizations and the students contributes factors facilitating the engagement and the learning of the students, as they interact with staff of the non-profit organizations and importantly with a diversity of disabled individuals helped by the organizations. The presenter discusses methodologies for initiating mentoring “one-on-one” relationships of the students with the disabled

individuals of the non-profit organizations. In the workshop, the presenter highlights the importance of the commitment of the president of the university and the dean of the school in the mission of service-learning, of the commitment of the management of the non-profit organization to the projects, and of the energy and the initiative of the professors in service-learning. The importance of project management of the non-profit organizations by professors is also highlighted by the presenter. The workshop includes informative lessons learned by the presenter, interesting personal reflections of the students on the learning, which are required as reports in the courses during the semesters, and collective reflections of the disabled individuals and the staff of the organizations on the results. The workshop includes inspiring videos produced by the students of their relationships with the staff of the non-profit organizations.

Service-learning is based on the concurrent partnership of schools with an internal center for community outreach, which is also discussed in the workshop. Such centers are especially important for professors in deciding on non-profit organizations desiring help and in liaison of the organizations with the computer science and information systems schools. Funding of grants and incentives for innovation in curricula design and in empowering practices in service-learning is facilitated by partnerships with a center for outreach conveniently structured into a university. In this workshop, the presenter shares the positive relationship of their school with the center for community outreach of its university. This relationship fosters productive service-learning programs with non-profit organizations partnered with the school and the center, contributing to further success.

In summary, this workshop furnishes important pedagogy and partnership strategies that may be initiated by member-professors of the Southeast Decision Sciences Institute (SEDSI) considering formal integration of service-learning into the computer science and information systems curriculum, or even other curricula, of their institutions. The presenter of service-learning and technology at this workshop offers perspectives that will be useful to other professors at other universities considering expansion of service-learning within the interdisciplinary field of 21<sup>st</sup> century information systems and technologies that are integrating health care technologies. Syllabi of the presenter will be reviewed and shared at this workshop. This workshop will be interesting if not timely, as universities respond to the initiatives of *Service Nation* articulated by the President in Washington, D.C.

# **A DISCUSSION OF A CUMULATIVE PROGRESSIVE QUIZ STRUCTURE**

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## **ABSTRACT**

Weekly quizzes provide interim testing to assess the quality of student learning and motivate students to engage in additional studying. It is important to determine how well students are learning new topics, gaining skill and competence in progressively more difficult treatment of topics, retaining past topics, and thinking about applying topics to real problems. In this paper, a quiz structure is introduced that tests students on these four types of learning in a short one-page, four question format. The quiz structure development is discussed and two examples from an Operations Management course are presented.

*Keywords:* Testing; Business Education; Operations Management; Assurance of Learning; Assessment

## **INTRODUCTION**

Overconfidence and poor calibration of self-estimates of abilities and skills contribute to a common cognitive bias that can be observed at all levels of skill but is particularly severe in novices (Kruger & Dunning, 1999). Students who are overconfident about their learning may fail to engage in sufficient amounts of study (Koriat & Bjork, 2005) and frequently employ strategies that are not optimal for learning (Karpicke, Butler, & Roediger, 2009; Kornell & Bjork, 2007). One strategy that instructors might adopt to improve student learning is to test students frequently to provide frequent and immediate feedback about the quality of their learning and identify areas of weakness that need additional study. McDaniel, Roediger, and McDermott (2007) review the benefits to student learning that can be realized by frequent testing.

Quizzes provide interim testing to measure student learning prior to midterms or exams. As new topics are introduced, it is helpful to determine how well students are learning new concepts. Successive assessments help the instructor to determine the students' knowledge so teaching

strategies can be appropriately adapted (Wang, 2007). Testing calibrates students on the quality of their learning and provides feedback to instructors about the effectiveness of instructional strategies. As such, the use of student performance on course quizzes can provide the basis for continuous improvement of instructional strategies, which is an increasingly important element of maintaining program standing with disciplinary accrediting expectations (Maki, 2004; Suskie, 2009). After the topic is introduced, it is important to gauge whether a student can calculate a more complex problem and interpret the solution. Later in the course, it is important to determine if the student has retained the new knowledge (Mukherjee, 2002). Finally, it is essential to determine if the student can demonstrate the use of their new knowledge to identify challenges and propose appropriate methods to solve real problems (Evans, 1995; Pringle and Michel, 2007). This paper proposes a new one-page quiz format to perform these assessments weekly. Each of these types of assessments is discussed in the context of the productivity and project management concepts covered in an introductory undergraduate course in operations management. Two sample quizzes are presented to illustrate the quiz structure. The paper concludes with directions for further research.

### **PROPOSED QUIZ FORMAT**

Critical thinking skills are essential for student success. A cumulative progressive quiz structure was developed to help undergraduate students learn the material and work progressively toward solving realistic problems. The proposed quiz format was designed for the last 15 minutes of an undergraduate class each week. Students are given the one page quiz and an accompanying formula sheet since the goal is for students to apply the formulas rather than memorize them. Every week, each quiz has four labeled questions: New, Progressive, Review, and Application. Each question carries equal weight on the quiz. A practice quiz is given the first week with the 4-question format so that students have an opportunity to experience the quiz format in a timed class setting.

An overview of the weekly one-page quiz format with the labels in parenthesis is:

- 1) a new introductory level problem from that day's lecture (New),
- 2) a progressively more challenging problem from recent lectures (Progressive),
- 3) a multiple choice review problem (Review), and
- 4) a conceptual application question to be answered in approximately 15 words or less (Application).

Each of these types of questions is discussed in detail in the context of productivity and project management learning outcomes included in an introductory undergraduate course in operations management.

### New Questions

The purpose of the new question is to test students when a concept is introduced to assess student learning and quickly identify any confusion on the day a topic is introduced. For example, on Quiz 2 shown in Figure 1 in the Appendix, the first question only tests students on the forward pass of the critical path method using deterministic data, a concept which is introduced in that day's lecture. On Quiz 3 shown in Figure 2 in the Appendix, the first question tests students on calculating the expected task time for each task and then completing both a forward and a backward pass of the critical path method. This sequence of weekly operations management quiz questions provides an opportunity to measure weekly progress in student learning and to close the loop by making appropriate adjustments to instruction such as discussing additional examples. Assessment of student learning and subsequent improvements to curricula and teaching methods are important to the new assurance of learning standards promoted by numerous accreditation programs including AACSB (Pringle and Michel, 2007; LaFleur *et al.*, 2009). The new question has a free response format to provide opportunities for individualized feedback.

The new question also encourages students to be engaged in the lecture rather than cramming for the quiz during class because the new concept introduced will be on the quiz. After students are introduced to concepts, they are asked to work progressively harder questions that require a cumulative understanding of the material.

### Progressive Questions

The purpose of the progressive question is to test students on a more advanced concept that has been developed over multiple lecture periods. For example, once students learn how to calculate labor productivity, a more progressive concept is how to calculate multi-factor productivity. Likewise, once a student has learned how to perform critical path analysis for project management, a more progressive concept is to illustrate the results in a Gantt Chart as shown in question 2 on Quiz 3 in Figure 2 in the Appendix. The Progressive question has a free response format to allow for individualized feedback.

### Review Questions

The goal of the review question is to help students retain the material for longer periods of time through repeated review and testing (McDaniel *et al.*, 2007; Martell, 2007; Mukherjee, 2002). Review questions help students prepare for their midterm or exam; they also help students remember the concepts beyond the course so they can apply them in more advanced classes such as Policy Analysis and Formulation and in their future careers.

The format of the review questions is multiple-choice because students have already been tested on this material with open-ended questions. This helps the instructor allocate more time to

provide detailed feedback on the newer material in the new, progressive, and application questions and manage the weekly grading load.

### Application Questions

The goal of the application question is to require students to identify challenges in application and propose an approach to manage them. Application questions require that students understand the assumptions and data input information for each method taught in class. For example, question 4 on Quiz 2 shown in Figure 1 in the appendix asks students to identify the use of the critical path method to determine how long it will take to add a new exhibit to a local zoo. Likewise, question 4 on the quiz shown in Figure 2 in the appendix asks students to discuss what steps to take when a project is likely to be delayed. These questions require students to think about the application of course concepts. Students must demonstrate their understanding of business concepts covered in class by discussing the application of those concepts in the context of a particular scenario (Pringle and Michel, 2007). Local businesses, such as the local zoo in application question 4 in Figure 1, can provide a context for the application problems. Since the application questions require the student think about and answer an open ended question that tests their ability to apply course concepts, they require the student to demonstrate a higher level of learning than the previous questions.

The format of the application question is brief free response. Students are encouraged to be succinct.

## **DATA COLLECTION AND PRELIMINARY ANALYSIS OF RESULTS**

From an Operations Management course of 29 undergraduate students, 15 students signed informed consents to be included in a research study approved by the UWF Institutional Review Board. For each type of question, we analyzed the results from Quizzes 2 and 3 shown in Figures 1 and 2 respectively.

### New Questions

Of the 15 students, 11 performed well on the first new question on Quiz 2 while 11 performed well on the first new question on Quiz 3 in Figure 2. Performed well is defined as scoring 92% or higher (at least 23 out of the 25 points) on the question. Considering the substantially harder backward pass included in the first question on Quiz 3 in Figure 2, these results support the successive teaching and assessment approach.

### Progressive Questions

Out of the 15 student sample, 11 students performed well on both the new question 1 and the progressive question 2 on Quiz 3 in Figure 3. Since this particular progressive question required students to use data from the critical path method in question 1, it was encouraging that all students who completed question 1 could also use their work to draw a Gantt Chart in question 2.



### Review Questions

The performance results for the 15 student sample on review questions were that 13 students performed well on review question 3 on Quiz 2 in Figure 1 while 14 students performed well on review question 3 on Quiz 3 in Figure 2. Student feedback about including review questions on past quizzes has included one student's remark that "it was a good teaching method used by you with your quizzes. By putting old information on new quizzes allowed me to keep up to date on all the information and that information has and will continue to stay fresh in my mind."

### Application Questions

For the 15 student sample, 12 performed well on the application question on Quiz 2 in Figure 1 while 9 students performed well on the application question on Quiz 3 in Figure 2. Student feedback included one student writing for Quiz 2 in Figure 1, "The application question on the quiz was not very clear;" yet this same student scored 100% on the application question. Other anecdotal feedback was similar that some students perceived the application questions to be the hardest.

In general, student feedback in class has been that they like the short quizzes and were motivated by them to persist in their studies. Informal observations were that students came to class more prepared for in-class discussion and required less prompting to complete in-class activities.

## **DIRECTIONS FOR FUTURE RESEARCH AND CONCLUSIONS**

Analysis of student performance on the quizzes will focus on assessing student performance over time with new, progressive, review, and application questions. Collaboration with our university's Center for University Teaching, Learning, and Assessment will provide additional assessment of such data.

Reviewing the weekly quiz results with the students provides opportunities for follow-up discussion as well as introduction of new topics with familiar problems. For example, after returning the graded quiz 2, the forward pass in problem 1 was reviewed and then extended to include a backward pass to introduce a new concept.

In conclusion, this paper presents a new quiz format to assess student learning over time. The proposed quiz format seeks to assess student learning on newly introduced concepts, cumulatively harder concepts, past concepts, and the application of concepts. It is being applied to two sections of undergraduate operations management and performance will be analyzed in the future. In-class feedback has been that the students like the quiz format and feel that it motivates them to keep up with the material.

## ACKNOWLEDGMENT

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## Appendix

In the appendix, the operations management Quiz 2 and Quiz 3 are shown to illustrate the four-question format to assess learning. Quiz 2 is shown in Figure 1 while Quiz 3 is shown in Figure 2. Figure 3 contains the formula sheet that accompanies Quiz 2 and Quiz 3.

Figure 1. Operations Management Quiz 2 with 4-Question Progressive Format

**New**

1. Draw the network diagram and complete the forward pass for the following project management problem.  
Space for network diagram:

Task	Activity Time (weeks)	Immediate Predecessor	ES (Earliest Start)	EF (Earliest Finish)
A	5	--		
B	8	A		
C	12	B		
D	4	A,B		
E	7	C,D		

**Progressive**

2. Yesterday, the Zoo Northwest Florida Safari Limited Train had 400 passengers, daily labor input 12 hours, daily labor cost of \$10/hour, an energy cost of \$0.20/passenger, and an overhead cost of \$0.30/passenger. If overhead cost goes up to \$0.40/passenger due to hurricane insurance premium increases, what change in daily energy cost will be required to maintain the same multi-factor productivity as yesterday? Explain your logic.

**Review**

3. Last night the Zoo Northwest Florida moonlight eco-adventure tour required 40 hours labor at \$10/hour and additional energy at \$50/hour for 5 hours and 400 customers paid to go on the tours. What was last night's multi-factor productivity? Clearly circle only one correct lettered answer.

- a. 400 customers/\$
- b. 6.7 customers/\$
- c. 2.6 customers/\$
- d. 1.6 customers/\$
- e. 0.62 customers/\$

**Application**

East African antelopes

4. If the Zoo Northwest Florida is expected to acquire two new sitatungas in January. Describe in 15 words or less the project management steps to determine how long it will take to expand the habitat.

Figure 2. Operations Management Quiz 3 with 4-Question Progressive Format

Network Diagram

New

1. Complete the forward and backward passes for the following project management problem. Then determine the expected project completion time and the project variance.

```

    graph LR
      A((A)) --> B((B))
      A((A)) --> C((C))
      B((B)) --> E((E))
      C((C)) --> D((D))
      D((D)) --> E((E))
    
```

Table 1 contains the task and immediate predecessors (Immed Predec) for a project as well as a=optimistic, m=most likely, and b=pessimistic task times. Please fill in the  $t_e$ =expected task, ES=earliest start, EF=earliest finish, LS=latest start, and LF=latest finish task times.

Table 1. CPM/PERT Problem Project Tasks: Times Are in Days.

Task	Immed Predec	a	m	b	$t_e$	ES	EF	LS	LF	Slack	Critical	Task Variance
A	--	2.0	7.0	12.0								
B	A	4.0	7.0	10.0								
C	A	4.0	4.0	4.0								
D	C	2.0	2.0	2.0								
E	B, D	4.0	6.0	14.0								

Expected project completion time: \_\_\_\_\_

Project variance: \_\_\_\_\_

Progressive

2. Draw an ES-EF Gantt chart for the project in Table 1 using the grid below.

Task	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
A																									
B																									
C																									
D																									
E																									

Review

3. If the Zoo Northwest Florida's Gift Shop required 15 hours labor and served 480 customers yesterday, what was labor productivity? Clearly circle only one lettered answer.

- 480 customers/hour
- 42 customers/hour
- 37 customers/hour
- 32 customers/hour
- 15 customers/hour

Application

4. If Zoo Northwest Florida has a project that will finish with probability 0.80 by the project due date, what should the project manager do and why in 15 words or less?

Figure 3. Operations Management Formula Sheet for Productivity and Project Management

**Productivity Formula Sheet**

$$\text{Single-factor productivity} = \frac{\text{Output}}{\text{One Type of Input}}$$

$$\text{Multifactor Productivity} = \frac{\text{Output}}{\text{Labor Input} + \text{Material Input} + \text{Energy Input} + \text{Capital Input} + \text{Misc. Input}}$$

=====

**Project Management Formula Sheet**

Six Steps of CPM (Critical Path Method):

1. Define the project and prepare the work breakdown structure
2. Develop relationships among the tasks - decide which tasks must precede and which must follow others
3. Draw the network connecting all of the tasks
4. Assign time and/or cost estimates to each task
5. Compute the longest time path through the network – this is called the critical path
6. Use the network to help plan, schedule, monitor, and control the project

ES = Earliest Start = Max (EF of all immediate predecessors)

EF = Earliest Finish = ES + Task time

LF = Latest Finish = Min (LS of all immediate following tasks)

LS = Latest Start = LF – Task time

Slack = LS – ES or Slack = LF – EF

**Setting up a Table for CPM:**

Tasks	Task times, $t_e$	Immediate predecessors	Forward pass		Backward pass			Critical?
			ES	EF	LS	LF	Slack	

**Expected task time:**  $t_e = \frac{a + 4m + b}{6}$

**Dispersion or variance of task completion time:**  $v = \left[ \frac{b - a}{6} \right]^2$

$\sigma_p^2 = \text{Project variance} = \sum(\text{variances of tasks on critical path})$

$\sigma_p = \text{Project standard deviation} = \sqrt{\text{Project variance}}$

# Collaborating Across Classes to Enhance Learning and Decision Support Application Development

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## Abstract

The hands-on experience gained through class projects is a valuable component of the learning process. Live projects that challenge students to solve a real problem for a real client often enhance the benefits of class projects. However, when students enroll in multiple project-based classes the number of projects can detract from the students' studies and spread them too thin. By collaborating on a single project that satisfies the requirements for multiple classes students may pool their knowledge, learn from each other, gain a broader understanding of a subject, and produce more valuable applications. This paper describes a student-driven experience in which students collaborated on a live project across multiple classes and developed a decision support application that is being used today. The paper also proposes a model to facilitate collaboration across classes.

## 1 Introduction

The hands-on experience gained from class projects engages students, reinforces concepts, and promotes a deeper understanding of core principles. Live projects, in which students solve real problems for real clients, offer several benefits over mock projects such as the increased motivation that comes from developing an application that will be used. Although projects provide many educational benefits, projects may create additional challenges. If a student enrolls in too many project-based classes the projects can overload the student and hinder the learning process. Projects involving real problems often exceed the capacity of a single course. Collaborating on projects across classes allows students to tackle more challenging problems while enabling students to focus their time and energy on a single project. Additionally, many students want to take more classes than time permits and collaborative projects allow students from different classes to work together which exposes the students to more classes without increasing their work load.

As academicians we have an implied responsibility to create positive and productive learning environments for our students. When students draw tenets among classes their learning experience is greatly enhanced. Combining a low-level design and implementation course with an application-level course enables students to see the complete, end-to-end picture and explore new and more creative ways to address problem solutions. Each course motivates the project development process and enriches the learning experience. Greater conceptual value of an application creates a heightened desire to understand and explore technical details thus producing a broader view of opportunities at the application level. Accordingly, students begin to think well outside the box.

The Department of Information Technology at Radford University offers Bachelor of Science degrees in Computer Science (CS) and Information Systems (IS). Students must complete one of six concentrations; four offered by the CS program and two offered by the IS program. Each concentration includes three courses in the area of specialization. The curriculum is heavily based on projects to balance theory and practice and many instructors use live projects. Unfortunately,

students often find themselves spread too thin across multiple projects. Allowing students to develop a single project that satisfies project requirements for multiple classes enables students to focus their time and effort while enhancing the learning potential of the project.

This paper describes a student-driven experience where students collaborated on a single project across four classes. The paper also proposes a model to facilitate collaboration across classes.

## 2 Live Student Projects

The use of live projects in computer science and information systems courses provides a number of benefits to students. In addition to the motivation that comes from developing a real system, the value of students seeing “the results of their work actually used” cannot be underestimated [2]. Tan and Phillips [9, 10] concluded that live projects provide students experience with realistic situations, strict timelines, teamwork, written and oral communication skills. Song [8] found that live projects ease the student’s transition into industry and Poger and Bailie [7] describe the benefits of experiencing the unstable environment of working with real clients with changing needs. Grisham, et al [3] express this same concept as the “challenge of working with a large, complex project with uncertain requirements.” This unstable, uncertain environment motivates the need for good software engineering practice.

The main benefits that students derive from live projects may be summarized as: (1) increased motivation from producing an application that will be used by a client, (2) improved communication skills from working with a client rather than an instructor, and (3) experiencing the challenges of working with a real client to solve a real problem.

While live projects offer many benefits to students, live projects require significant support before a class begins and long after the class project ends. Clients must be identified, proposals must be reviewed, project scope must be constrained to fit the length of the class, and the applications that are developed must be maintained and supported throughout the lifetime of the application. In 2006 the Information Technology department at Radford University created the Small Project Support Center (SPSC) to coordinate live student projects and to support the applications that are delivered and deployed into production [1, 4, 6].

## 3 Collaborating Across Classes

As shown in table 1, three students collaborated on a single project across four classes. The project was initially defined for the Decision Support Systems class and the Data Warehousing, Data Mining, and Reporting class in spring 2009. The project was extended for the Information Systems Capstone class in spring 2009 and it was expanded again to satisfy the project requirement for the fall 2009 Web Development class. This section describes the classes that motivated the initial project.

Course Title	Student 1	Student 2	Student 3
Web Development	X		
Data Warehousing/Mining	X		
Decision Support Systems	X	X	
IS Capstone	X	X	X

Table 1: Course enrollment by project team members.

### **3.1 Data Warehousing and Data Mining Course**

The database concentration includes three database courses: an introductory course on database applications similar to [11], a second course that covers the database management system (DBMS) and database administration, and a third course on Data Warehousing, Data Mining, and Reporting. The third course is designed to attract IS students.

The topics covered in the third course are evenly divided between data warehousing and data mining. As described in [5], the data warehousing portion of the course covers dimensional modeling, online analytical processing (OLAP), aggregates, the extract, transform, and load (ETL) process, and the physical schema. The second half of the class focuses on applying data mining techniques such as decision trees, association rules, and clustering.

Students in the data warehousing and mining course complete a design project that comprises twenty percent of their grade. The students pick a domain that interests them and they write two design documents to analyze some aspect of their domain. The first essay requires students to design: (1) a simplified operational system to collect data, (2) a Star schema with at least two fact tables and aggregate tables, (3) an ETL process to migrate data from their operational system into the warehouse, at least one report, and a dashboard that monitors at least one key performance indicator (KPI). Students must provide schema diagrams for their operational and warehouse schemas, SQL view definitions for the aggregate tables, and SQL queries for their reports and dashboard monitors. The second essay requires the students to design two data mining applications for their domain. Students must describe the data set for each model and they must describe the process of building, testing, and using their data mining applications.

Students are encouraged to model their essays as a proposal for a current or future employer and to include their project essays in their interview portfolio. Example projects include an inventory management system for an apartment complex that optimizes inventory levels to minimize cost and maximize customer satisfaction, a project tracking system that identifies high risk projects and provides suggestions to improve performance, and a system that analyzes motorcycle accidents to identify dangerous areas and predict safety ratings for drivers.

### **3.2 Decision Support System and Expert Systems Course**

The Decision Support/Expert Systems (DSS/ES) course is designed as a senior level information technology course with the expectation that participants will achieve many learning outcomes. Students have completed or are in the process of completing a majority of the required coursework for their degrees. Course content includes the typical areas expected in such a course. In addition, students are expected to complete and present a semester long DSS/ES project.

This is a required course for students majoring in information systems. IS students enter the course having completed studies in technology and business while CS students possess more in-depth backgrounds in technology and take the course as an elective. Regardless of their backgrounds, students are expected to develop projects that incorporate knowledge from various areas of their studies. Students enter an environment that challenges them to capitalize on their knowledge and skills to meet and surpass minimum levels of expected outcomes. Students are expected to go beyond their customary perimeters of vision and see the larger picture by discovering and applying interrelationships of knowledge.

A typical DSS/ES application is designed to help users make better decisions by identifying options available to them. DSS applications collect information about a problem starting with general details and move through a series of more specific levels of detail. Students must incorporate these tenets into their projects by identifying the variables that are most relevant to the





Figure 1: Screen 1

decision making process. Students must adjust their level of abstraction while moving from the general to the specific and operationally define their movement in the presentation of a finalized product at the end of the semester.

Students may work individually or with a partner. The instructor meets with each student or team to plan the project development process. Throughout the semester the instructor meets with the students several times to conduct a “discovery” or “interest session” dialog. These meetings explore and clarify new ideas or reveal new areas of research to provide constructive feedback while the project is under development. These meetings tend to produce better projects and increase student involvement. Moreover, the meetings provide a channel for students to experience greater ownership of their work. Many students have found or identified specialized areas of interest they would like to pursue in their careers.

#### 4 A DSS Application for the Small Project Support Center

Two students in the Decision Support and Expert Systems (DSS/ES) course wanted to develop a DSS application to support the mission of the Small Project Support Center (SPSC) while meeting the project requirements of the DSS course. They wanted to create an online application to help university groups determine the economic viability of using the SPSC as opposed to mainstream outsourcing of projects. The students wanted to emphasize that the SPSC typically delivers prototypes rather than finished products. Potential clients must understand this important difference between the SPSC and outside vendors.

The students created an online application to guide potential clients through the discovery process of determining whether or not services provided by the SPSC would be a “good fit” for them. The process begins by posing the question, “Can the SPSC work for you” and the subsequent interactive dialog seeks to determine the degree to which the SPSC may assist the user. The opening screen of the application is shown in Figure 1.



Figure 2: Screen 2

From the initial screen the user is directed through a series of questions asking if the software is to be purchased or developed in-house, the level of support required, and estimated hours of development to complete the project. The end result of the consultation is to determine whether or not a superficial review of the users' needs could be met by the SPSC. The user is also provided with a cost estimate that is sent to their email account. The estimate approximates the cost of having students in the SPSC complete and maintain the proposed application. An example of the final cost estimate is shown in Figure 2.

## 5 Facilitating Collaboration

This project came about because one enterprising student was able to define a project that satisfied the requirements of four classes. This student was able to coordinate the project across these classes because he was enrolled in all of the classes. It would be interesting to see how a project team performs when no one student is enrolled in all of the classes.

An organization like the Small Project Support Center could coordinate projects across classes and even post projects to an online application that would allow students from different classes to form a project team. The first step would be to identify sets of synergistic classes that cover related topics; classes like the Decision Support Systems class and the Data Warehouse, Data Mining, and Reporting class. Once the candidate courses have been identified, the second step would be to work with the instructors, clients, and students to define potential projects. Finally, the organization would coordinate and manage the projects to ensure that the needs of all the stakeholders are being met.

## 6 Conclusion

Class projects engage students, reinforce concepts, and promote a deeper understanding of core principles. Live projects provide additional benefits to students while developing valuable applications for real clients. Employers value the experience that our students gain from the many project-based classes in our curriculum. This paper described an experience driven by students to develop a single project that satisfied requirements across four classes. Collaborating on a project enables students in multiple project-based classes to focus their time and energy, to tackle more challenging problems, and to learn from students in other classes. An organization like the Small Project Support Center at Radford University could facilitate collaboration by coordinating projects across classes.

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# Applying Agile Methodology to a Community Engagement Project in Africa

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## Abstract

Community engagement courses continue to be adopted by instructors in higher education institutions. This paper proposes to analyze factors of agile methodology that contributed to an engagement project of a Web site in southern Africa. The project began in an independent project study of a student in a school of computer science and information systems in the United States. The findings from a preliminary analysis of the factors indicate that agile methodology on an appropriate community engagement and international project is a critical enabling process impacting success. This paper may benefit instructors considering an expedited process for community engagement projects which are international in nature and involve Web technology.

**Keywords:** Africa, community engagement, computer science and information systems, service-learning projects, and world-wide Web

## Background

Community engagement or service-learning is defined as an educational experience in which students engage in an organized activity that helps and meets identified needs of a community organization, such that students gain a further appreciation of the discipline (Bringle & Hatcher, 1995). Service-learning is defined in the literature as a form of experimental education (Jacoby, 1996) that enables the engagement of students. The design of the learning is in a course-included project or service to a non-profit organization that enhances the experience of the students in issues of the organization and in lessons of community responsibility (Lawler & Li, 2005), from which they further reflect on the service. There are almost 1,000 higher education institutions in the United States that have service-learning in their schools (Spence, 2004), including schools of computer science and information systems (Sanderson, 2003), in which the learning is considered significant (Saulnier, 2005). Methods of service-learning in the schools may not be consistent however for instructors considering an ideal process for community engagement projects.

Agile methods might be a process for community engagement projects, as agile methodology is defined as a flexible and iterative process enabling fast incremental deliverables (Beck, 2000). Extreme programming (XP) is considered to be the best known and most popular of agile methodologies (Conn, 2004). Conditions or factors of the methodology, as applied to appropriate projects, consist of *acting on change vs. following a plan*, *collaborating vs. negotiating a contract*, *doing the project vs. documenting detailed and fixed requirements*, and *interactions of participants vs.*

*processes* (Boehm, 1986). Faster delivery of projects, and flexibility in the implementation of project requirements, at lower costs, are noted to be benefits of agile methodology, in contrast to a non-agile process. Agile methodology might be an ideal process for community engagement projects to be implemented in a short semester of service-learning or incrementally in subsequent semesters, in schools of computer science and information systems.

This paper proposes to analyze factors of agile methodology defined in the aforementioned literature (Beck, 2000 & Boehm, 1986) that might contribute or not contribute to a process enabling project success in a course or program of study of service-learning in schools of information systems. The benefit of a paper might be in clarifying the degree or extent of impact of the methodology on projects resulting in systems that have to be maintained by the non-profit organization, once a course or study is concluded at the end of a semester, such that the system may or may not be a success. Non-agile methodology might be a better process than agile methodology for the non-profit organization, depending on the project. The favorable inclusion of agile methodology in a course or program of study on service-learning or non-service-learning is not considered to be definite in the curricula of schools of computer science and information systems. This paper might furnish input into agile methodology and service-learning, beginning with an exciting international project involving Web technology.

### **Description of Project**

The project began in fall 2008 when a former student in a community engagement Web Design for Non-Profit Organizations course in 2003 contacted the author of this paper, who is the instructor of the course. The course “changed the life” of the student and led him to join the United States Peace Corps in Namibia in 2007. In Namibia he encountered first hand the problems of education and health and poverty, which is rapidly spreading HIV / AIDS in southern Africa. The student contacted the instructor by e-mail to do a project for a Namibia Charity Climb and Ride Web site that could draw attention to the Namibian situation. This student envisaged the basic features of the site. The instructor initiated the project with another instructor and a Web design experienced part-time student, in an independent project study in the school of computer science and information systems of his university, in the United States.

The goal of the first phase of the Charity Climb and Ride site is to educate audiences in Africa, Europe and North America of the problems in Namibia that could attract donations. The highlight of the first phase of the site is information on scheduled 1,500 kilometer biking programs to Brandberg Mountain, the highest peak in Namibia at 2,572 meters, near Usakos, to which donors are asked to contribute dollars per biked kilometers and per meters climbed by Namibian bikers. The instructors and the student in the United States developed and implemented a customized credit card facility on the site, so that donors could contribute the money to the biking programs, and the donations in progress will be applied to establishing a center in Skoonheid for educating local Namibians on health. The site links to international sites, such as the Peace Corps, and

other organizational social and sponsoring sites, such as Omaheke San Trust. The Namibia Charity Climb and Ride site was implemented incrementally in the first phase in winter 2008 and spring 2009 (Coppola, Lawler & Nixon, 2009), and further planning of other functions and programs will be initiated in 2009 and 2010.



**Figure 1: Namibia Charity Climb and Ride Site – Phase I**

The project is an example of conditions described in the Agile Manifesto (Boehm, 1986). The Charity Climb and Ride site was enhanced frequently and implemented incrementally in iterations of a few months, by the self-initiated student in the United States, with few and incomplete Namibian documents and requirements. The focus was on a primary process of a donation system, envisioned by the former student in Namibia, such that other requirements were not intruding on the primary if not simple system. Inasmuch as dial-up e-mail was the forum of interaction with Namibia, as other processes, such as social networking or video-conferencing, were ineffective and slow in southern Africa, neither the instructors nor the student in the United States interfaced in person with the former student or the staff in Namibia, which at the same time was inconveniently in a separate time zone than the United States. The inefficiency of the process is an example of an international project in the Third World (Ojo, 2003). Except for the location of the players, which inevitably is a problem if not a risk on an international project (Ambler, 2009, Public CIO), *acting on change vs. following a plan, collaborating and doing vs. negotiating a contract, doing and enhancing the project vs.*

*documenting fixed requirements*, and as feasible *interacting vs. procedures or processes* were evident in degrees of impact as inherent methods of extreme programming (Beck, 2000) on the Namibia Charity Climb and Ride site.

### **Methodology of Study**

The methodology of the paper proposed by the author is to analyze the aforementioned factors, and even expanded factors or principles, of the Agile Manifesto, as to high to low degrees of enablement on the Namibia project as further functionality and other programs are included on the Charity Climb and Ride site. Further programs in 2009 and 2010, and into 2012, might include more intricacy on the site, which might necessitate an increase in the number of students in the United States on the initiative, but increasing the creditability of an analysis. Ideally more projects relating to service-learning and the Web, as a result of the Charity Climb and Ride site, might be eventually initiated in southern Africa with the university, which might further increase the creditability of an analysis relative to international projects. Literature is limited on processes of service-learning success (Wilcox & Zigurs, 2003). The paper may furnish insight into international service-learning success.

### **Preliminary Descriptive Analysis**

The analysis of the current factors of agile methodology on the newly implemented Namibia Charity Climb and Ride site is generally indicating the bulk of the factors as an enabling process impacting initial success.

The instructors and the student in the United States acted early and immediately in designing, developing and implementing the site, and continuously improved the site in stages or sprints, based on the vision of the former student in Namibia but without a detailed preconceived plan – *acting on change vs. following a detailed plan*.

Though the collaboration of the students in Namibia and the United States was constrained by limitations of an international project in the Third World, the project was essentially self-initiated by the student in the United States, who cared about the site (Saulnier, 2003) – *collaborating and doing vs. negotiating a contract*.

The student in the United States was not constrained by formal methodological procedures – *doing and enhancing the project vs. documenting fixed requirements* and by e-mail interacted or interfaced on iterations of the prototyped site with the former student in Namibia and his Namibian staff as needed, resulting in a satisfactory site (Morien, 2006) – *interactions vs. procedures or processes*.

The bulk of these factors in a degree of a frequent high describe an agile methodology that impacted the success of the site in 2009.

## **Preliminary Implications**

The preliminary implications of the paper are that instructors might further integrate agile methods into appropriate projects in a community engagement course or an independent project study involving international organizations. The duration of the course or study in a limited semester might be filled with agile methods on the projects. This might be more enabling in impact than if non-agile methodologies filled the semester.

Projects in a community engagement course or study involving international outsourcing might also include agile methodologies (Ambler, 2009, Global Services), an extended implication of the paper.

The flexibility of the instructors in not inhibiting the students in the United States or in Namibia in initiative is a further implication of the paper. The model of service on the Namibia Charity Climb and Ride site was of problem solution (Heffernan, 2001) – pure and simple. The implementation of the model was in an independent project study of a student, which provided a solution as if in a course study of students or student teams, and the solution was of self-sufficiency of the Namibian staff, and moreover the student in the United States was positive in her reflection on project service and the results of the service.

The final implication of this preliminary paper might be that instructors should not be intimidated by international projects in the Third World (Bolton, 2008 & Hamm, 2009), as agile methodology might be an ideal strategy.

## **Limitations and Opportunities in Research**

Clearly the project in the current first phase is lightweight and is a limitation of the paper. The inclusion of more students on the next phases of the Charity Climb and Ride Web site, more project tasks on the site, and more tasks on other projects or sites of other organizations involving service-learning and Web technology in southern Africa, increasing creditability of analysis and empirical interpretation, is the next step. This is envisioned by the author potentially in 2010 -2012.

## **Conclusion**

In conclusion, the goal of the paper is to analyze the features of agile methodology that contributed to the implementation of the current project of a Web site in southern Africa, and in the next paper, the features of the methodology that may be applied to continuously more functionality, programs and tasks on the new site in 2010-2012. The findings from an improved paper may benefit community engagement instructors experimenting in agile methodology frameworks on international projects. The future of



community engagement in the curricula of schools of computer science and information systems might be in international projects involving service-learning and Web technologies in the Third World (Gohring, 2009), where agile methodology might be a solution.

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## Case-based Teaching: Three Approaches to Online MBA Instruction

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Abstract

Case-based teaching is popular and on-line teaching is increasingly popular, particularly in graduate distance education settings. The authors all have experience in both, and have become interested in the different approaches and outcomes associated with the issues of case-based teaching. This paper will outline their three different approaches to delivering MBA distance education course in their eastern university college of business, and initiate a methodology to measure the effectiveness of alternative case-based method deliveries with an eye toward optimizing both within and across course deliveries.

Introduction

Two general models of business instruction might be classified as lecturing, based in the communication of facts and ‘information’, and a cluster of approaches called *case-method* teaching, student-centered learning, active learning, experiential learning, discussion-based teaching, and the like (O’Hara 2008). Given case-based teaching’s hallowed history in business education and indeed its central role in the pedagogy at some of the world’s top graduate business programs, how can it be that we still don’t know which approach is better, or which is better for what? A broad-based search of ABI-Inform reveals surprisingly little exploration of this topic and even fewer empirical efforts aimed at assessing case-teaching’s effectiveness.

Online teaching has grown in popularity, with demand by time-and-geographically-challenged MBA candidates exceeding even the explosive growth in the general market for university-level education. The intersection (or collision) of case-based, MBA-level instruction with the challenges of teaching online in an asynchronous environment is inevitable (Klebba and Hamilton 2007). This paper outlines current teaching practice for three popular case-based MBA classes at a large eastern university that offers both asynchronous online and face-to-face instruction. In addition to reviewing current practice and results/student feedback, we offer insights obtained from our nascent efforts to empirically assess the effectiveness of alternative approaches and technologies.

### Case-based Teaching

The essential principle behind case-based teaching is that the students learn more from application of tools and techniques than as mostly passive recipients of lectures. In essence, case-based teaching is an outgrowth of the Socratic method of teaching. Socratic inquiry follows the process of posing questions for the students to answer, and in developing the answers, the students learn. This is opposed to the Aristotelian approach, which favors lectures for imparting wisdom from the professor to the student. Sidestepping, for this paper, the relative merits of the two approaches, case-based teaching poses a substantive course/discipline-relevant question for the students to deal with, and the class becomes an exercise in finding a solution to the situation raised by the case.

In a face-to-face classroom setting, implementation is fairly straightforward. The professor assigns the case, helps the students understand the case and establish the issues that need to be addressed. If needed, the professor guides the students through any analytical procedures that might be called for, and then facilitates the discussion to reach a recommendation about the identified problems, perhaps leading to a presentation by one or more students about the case.

In a perfect world, on-line case-based teaching would exactly mimic this outline. In the current world of online instruction, compromises are inevitable. The three approaches outlined here make different choices to address these compromises toward the goal of maximizing learning for on-line graduate business students.

This discussion will proceed on the assumption that the case-based instruction will be in a primarily asynchronous environment. This means that to the extent possible, students will not be required to be “in attendance” at a pre-specified time.

### On-line Teaching

At our university, on-line (or distance education) students have grown to more than two-thirds of the MBA student body. The university and college have been ahead of the curve in providing access to not only technology (e.g. tablet computers and projectors) and applications (e-mail, webs sites, Blackboard, Moodle, Second Life, Centra, Mediasite and Camtasia, to name a subset), but also technical assistance to get the most value from these tools. This is not a paper about on-line teaching applications, so if a reader is not familiar with one or more of these, then s/he is requested to seek these out on his/her own. To this point, professors have been required

to teach both on-line and face-to-face sections of the same class. Tests are proctored, and at least 50% of the final grade must be based on work that is verifiably the student's alone. Professors are free to use whatever approaches they like, provided the on-line and face-to-face sections are equivalent. Some of us have chosen case-based teaching in our belief that it better 'seats' the higher-level/MBA business tools and more closely approximates actual application by managers.

### On-line Case-based Teaching Methodologies

#### Example/Approach 1: Marketing Strategy

One approach to case-based MBA-level teaching seeks to minimize the differences between the face-to-face (classroom) experience and results and delivery and results experienced by online/distance education MBA candidates in an asynchronous environment. This is particularly challenging given case-based-teaching's relative lack of structure, recognition of 'no right answer' and case-based-instruction's propensity (in the best of outcomes) to allow the students to follow their own instincts and arrive at their unique (and deeper-seated) learnings from a given business case study.

Face-to-face case instruction for MBA marketing strategy at our university follows a model almost universal for MBA programs worldwide: 1) students are assigned readings or other instructional materials that seek to convey tools and skill sets essential to their development as managers; 2) students are assigned a business case study (HBS, Darden, Stanford, EEEEC, INSEAD, or independently-professor authored cases, for example) that allows the students to apply these new skills or tools in ways that will be both memorable and transferable to analogous but dissimilar business settings in their careers. Cases are discussed in class as they are completed, with particular focus on key learning points or takeaways gained from the tools and skills covered in the outside materials. Students are assessed on written case analyses/write-ups (both individual and teams of 3-5 students) which follow a specific format, and on their in-class discussion of the cases (30% of their semester grade). Class discussion is most valued that addresses widely-held questions or advances classmates' understanding of tools or skills in the context of a given case. Upcoming cases are 'briefed' by the professor to provide some additional context. The professor holds five hours of on-campus office hours and/or meets with face-to-face students at alternative times as needed by mutual convenience. The above approach to case method has remained largely unchanged since its initiation at Harvard Business School in 1920.

Online case instruction for marketing strategy utilizes as much of the same approach as possible, with Blackboard and email the primary delivery and communication vehicles: 1) tools or skill set readings are identical to those for the face-to-face students; 2) the same cases are assigned; however, a fairly detailed three-or-four page 'case brief' written guideline is provided one week before written case analyses deadlines (again for both individual case analyses and for the analyses to be performed by teams of 3-5 students).

One significant difference in online marketing strategy instruction involves the online students' relative access to the professor: online students are encouraged to contact the professor during the week, outside of office hours as necessary. Online students all have the professor's home

and cell phone numbers in addition to email access, with email reply-times not to exceed twenty-four hours. Guidelines/boundaries are such that the students are urged to consider the professor's time/access as they would a manager's: they are not to call before 8AM nor after 9PM and they are directed (and learn) to think through issues and questions carefully before availing themselves of this particular resource. As in business, the professor is free to answer these calls based on workload and availability and the students leave voicemails or call-back numbers. In practice, this works well: our online students routinely feed-back that they have excellent access and experience relatively little frustration (a non-trivial outcome given case-based-teaching's inherent uncertainties and frustrations for most students).

Online student case analyses/write-ups are graded (generally within 48 hours) and returned with extensive, marked-up comments to the students/teams for their consideration and follow-on questions as appropriate. Several blind and marked up case write-ups are posted to Blackboard for general review and comparison. Students are further assessed (30% of their semester grade) on their participation in case-specific class-wide discussion boards where they consider the case, the blind-graded examples and offer their insights (and questions) for the class-wide forum. These discussion boards remain open for 4-to-5 days and the professor provides feedback on students' posts within 48-hours of each board's closing. Analogous to the face-to-face setting, successful posts are those that extend learning and takeaways for the entire class as well as for the individual student: posts that answer other students' more difficult questions or address universal questions are more highly valued and assessed.

Student feedback for our university's face-to-face MBA marketing strategy class has exceeded university and departmental norms for each of the six semesters that it has been taught using the approach discussed above; however, these norms/assessments are exceedingly general and provide little feedback on the efficacy of the case method beyond the occasional verbatim comments. There have been no real directional, much less statistically-significant, differences between student assessment scores for the online sections relative to the face-to-face sections. Students' case-writeups are graded 'blind', without the instructor's knowledge as to the submissions origin as either 'face-to-face' or 'online' and final grades are calculated 'within their respective sections' – online and face-to-face. Final grades are then statistically compared to minimize instructor bias and as a rough test of face-to-face and online learning comparability. There have been no statistical differences in section averages or in students' final grades based on the nature (online versus face-to-face) of their marketing strategy instruction over the past six semesters.

#### Example 2/Approach # 2: Management Information Systems

MIS is both a theoretical and practical discipline. In the MBA Introduction to MIS class at our university, students are assigned three professor-authored cases based on real-world scenarios.

In the first case, students have to develop a Microsoft Access database to help a business run more efficiently. This involves the creation of queries and reports that provide relevant business intelligence. Multiple forms are also created to wrap the queries and reports into a user-friendly application for the non-technical business user.

Since the typical business user/manager uses Microsoft Excel extensively in their day-to-day work, the second case requires the use of Microsoft Excel to make recommendations to aid in managerial decision making. To successfully complete this case, students are required to create formulas, use Pivot tables and charts to draw out patterns and ultimately “mine” the data to base their recommendations to management.

An essential characteristic of the 21<sup>st</sup> Century business environment is collaboration among virtual teams. So, the third case is designed to require students to work together in virtual teams and develop a joint paper with recommendations. For online students who are geographically dispersed anyway, this assignment fits in quite well. Many of the students consistently express what a great learning experience this project is and how it will practically and immediately have a positive impact on their careers.

This class is taught in both face-to-face and online environments. In the face-to-face class, the professor goes through the applications (both Access and Excel) in detail over several class periods. During these sessions, students can not only ask how-to questions but also any clarifications to the case instructions and requirements.

A combination of methods is used to provide the online students as similar an environment as possible. First, Camtasia, an excellent video capturing and editing software, is used to record lectures and demos on each application and are made available online. As the application features required to complete the cases are demonstrated, case-related connections that clarify the case requirements further are also made at appropriate junctures. One of the major advantages to this approach is the availability of these recordings for repeated viewings. The online students can view the entire recordings or the relevant portions at a pace that is most conducive to each student’s own learning style and preference. Links to other freely available tutorials and demos are also posted on Blackboard to supplement the professor’s video recordings.

To facilitate consistent and timely responses to students’ questions on the case, a Q & A board is available on BlackBoard. This acts as a central repository of all questions and responses related to the cases allowing students that may have the question at a later time receive responses before they even ask the question.

Several synchronous Centra chats are scheduled to further assist the students with clarifications and to answer any other questions on the case instructions. These sessions are recorded and available for viewing by the students unable to attend the session. The combination of the video recordings and Centra sessions has consistently been shown to provide the online students with very similar learning experiences as the face-to-face class. The evidence for this claim is shown by a lack of observed differences in the grades between the students in the two environments.

One possible reason this combination of methods seems to be effective in this class is the mostly “objective” nature of the cases. Unlike the open-ended nature of cases that use the Harvard-case format, these cases have fairly objective measures to evaluate them. Thus, as they work through the requirements of each case, students can evaluate with a lot of confidence whether their efforts are moving in the right direction or not without a lot of uncertainty.

The virtual collaboration project provides another very interesting comparison opportunity between the two delivery environments. The case requires a group of students to work together using a virtual collaborative platform such as Google Docs to research and propose recommendations for a business. They are expressly prohibited to use other media for communication. They may not use the telephone or email and most certainly are not allowed to meet face to face. This case, in a sense, levels the playing field for students in both environments.

### Example 3/Approach #3: Management Science

A third approach to case-based teaching is to rely heavily on Voice Over the Internet Protocol (VOIP) applications. A VOIP Learning Management System (or LMS, Centra is one such product) provides the on-line students the ability to interact with the professor and with their fellow students in real time. In addition, through the VOIP, students can share files (spreadsheets, documents, even presentations) in an interactive environment. Finally, the LMS will record any session so it can be reviewed by any student at any time.

An important feature of my case-based teaching is that, as completely as possible, on-line students are treated the same as face-to-face students. They have the same requirements and are graded on the same material. This requirement simplifies the situation, because a face-to-face section sets the standard for the on-line settings.

Providing the case is easy – an e-mail message is sent to all students, face-to-face and on-line, at the same time with the case statement as an attachment. This time is known in advance, so the students can anticipate the arrival of the case.

For the face-to-face students, the classroom is the setting for working to understand the case and the issues involved. This is the first setting where the VOIP application is used. While working with the face-to-face section, the VOIP LMS is activated, recording all questions asked (the professor has to repeat the questions into the microphone), answers provided, and, by using a computer hooked into a projector rather than a chalkboard, any work done on a computer is recorded as well. Thus all students, on-line or face-to-face, start off with the exact same information available to them.

Outside of class, the face-to-face students get together in groups to work on the cases. Meeting rooms are available for them to use, or they can pick any setting they like (library, classrooms, restaurants, wherever). For the on-line students, the LMS provides VOIP “meeting rooms” (called on-going sessions) where the students in a group (any or all of them) can meet to discuss the case and share their work. The on-line students don’t have as many options, but the option they have is available anywhere there is an internet connection.

Besides the classroom sessions (which are recorded for all students) and group work on their own (not supervised by the professor for either type of student), the face-to-face students can readily meet with the professor in his office. On-line students do the exact same thing, except that rather than coming to my office, they pick a time and we all meet by the VOIP application



(face-to-face students are also invited to these additional sessions). If the students are members of the group that will be presenting the case to the rest of the class, then the group makes an appointment with the professor to talk through the analysis and the presentation (usually a rough draft).

The final stage of working on a case is the presentation to the rest of the class. For the face-to-face students, they simply stand in front of their classmates and talk through a PowerPoint presentation. After completing the presentation, they respond to questions from the students and professor. For the on-line students, this is the one place where asynchronicity is lost. After the presenting group selects a time to present, the presenters are required to be in attendance. Non-presenting classmates are strongly encouraged to attend, and all have managed (so far) to attend more than one presentation in the course of a semester. The VOIP application is again used, this time with the student presenters running everything and the non-presenting students (and professor) logged in as spectators. Since the presentation is recorded, so any on-line student who cannot be present can download and view it later on, the video option is not used (file size would be too large for convenient down-loading). The on-line presenters “face” their classmates with only their voices and the PowerPoint presentation. At the end of the on-line presentation, however, the on-line presenters must still respond to questions from their classmates and professor.

As noted at the start, the VOIP LMS permeates nearly all aspects of working on the case with the on-line students. The LMS records the explanation of the case and the in-class work on the analysis of the data. The LMS provides a means for the on-line students to meet and discuss the case among themselves and with their professor. Finally, the LMS is the means by which the on-line students present the results and respond to questions. The two vital attributes of the LMS – to provide real-time interaction for feedback and to record all information for asynchronous viewing – make the on-line case-based teaching nearly identical to the face-to-face experience.

### Measurement, Evaluation and Conclusions

The three authors all have substantial experience in case-based MBA teaching in both face-to-face and on-line settings, and have each taken the steps they see as most useful in delivering optimal case-based instruction to distance-ed students. While there are fundamental similarities in both the objectives and execution of the three professors’ online MBA course deliveries, there are also substantive differences that may provide interesting variance in student outcomes.

The lack of a common grading rubric makes between-class comparisons challenging but comparisons within the classes, where there is no need to control for instructor, presentation, or content differences, should be meaningful.

Comparisons on the basis of rough draft grades, final grades on case write-ups and case presentations, grades on exams and overall grades in the courses will provide learning into the degree to which the case-based format is being effectively used each professor’s online classes, relative to the face-to-face analog. Comparisons between professors/classes may also begin to provide insight into which approaches constitute best-practices for on-line case-based teaching.

Preliminary results will be addressed and discussed at the SE DSI Conference in Wilmington in February, 2010.

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## USING SMS TEXT MESSAGING AS A NOTE-TAKING SYSTEM

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### ABSTRACT

Traditional note-taking systems have been key learning components in study skills courses as they have become popular and often required to entering freshmen; however, today's college students have a new tool that can be used for note-taking which is SMS text messaging. This paper discusses the need for faculty to teach text messaging as a valid note-taking system and one approach is an author developed software program that converts text messages into full text notes.

### INTRODUCTION

Students are going to text. This is an observable fact. Try as we might, faculty seem doomed to this 21st century phenomenon. In 2008, a study conducted by Knowledge Networks found that Generation Y, aged 13-29, sent 19.6 text messages a day [4]. As university professors, we can probably argue that these 19.6 text messages are sent in the course of a class period. The authors of this paper have decided to follow the adage, that "if you can't beat 'em, join 'em."

In an effort to increase the retention rates of entering freshmen, universities across the United States are requiring a course in study skills. This course can take the form of a one-hour seminar to a three-hour course taken within the students' declared major areas. The authors of this paper teach a three-hour course within the MIS department of their Business College. As well, the authors teach a high technology course for educators within this same department. Therefore, the focus of this paper is on how the authors have begun to use text messaging as a note-taking system to improve students' abilities to take notes, improve retention, and increase grades.

This paper will provide an overview of note-taking systems, briefly define SMS text messaging, and will introduce an author developed software program that is used to convert text messages (student notes) into a completed set of notes.

### NOTE-TAKING OVERVIEW

When the word, shorthand, is used in today's vernacular visions of the executive secretary come to mind; however, effective note-taking systems use a form of shorthand. Actually, formal shorthand systems are recorded as early as 350 BC, with Greek stenographic symbols being found on the Aropolis Stone [8]. Over 500 shorthand systems are recorded in the *History of Shorthand*. The modern era of shorthand began in 1588 England with Timothy Bright's published system of "Chracterie." However, it was Isaac Pitman (1837) and John Robert Gregg (1888) who were significant in shorthand as we know it. Both Pitman and Gregg used the phonographic approach, whereby words were written using symbols based on their

sound instead of their spelling. It is likely that the readers of this paper and/or attendees of the presentation learned either the Pitman or Gregg shorthand systems. In the 1980's and 90's Business Colleges began to use Dearborn's Speedwriting systems leaving the secretarial image behind. Emma B. Dearborn developed the system for the Stenotype shorthand machine used in court reporting, and later for use with handwriting in 1942 [8].

When reviewing textbooks for the three-hour study skills course, one is likely to find a chapter that includes note-taking systems. Common approaches to the content can be found in two textbooks, *Foundations for Learning* [2], and *Keys to Success: Building Analytical, Creative, and Practical Skills* [1]. The following three note-taking systems that are usually included in the textbooks are 1) outlining, 2) drawing think-links, and 3) the Cornell system. The outlining method is a system of indenting with the most important information to the left with progressive indents indicating various points below the main topic. To be successful in outlining the note taker must be "super organized," according to Student Academic Services (SAS), California Polytechnic State University [6]. Creating think-links is a visual form of note-taking that encourages flexible thinking. It is also referred to as a "mind map" or a "word web [1]." As opposed to using this method in a straight lecture setting, it can be more useful for the note taker in a brainstorming session. Finally, the Cornell system, also known as the T-system is a method of note taking whereby the student draws an off-center upside down "T" on the paper. The right (largest) section is used for taking notes, the left section is used for recording questions, called the "cue column," and the bottom section is the summary area. Students should be formally trained in the system, and it can be very time consuming unless the students can "do-it-right-the-first-time [6]." Hazard and Nadeau [2] indicate that the purpose of the Cornell system is to coordinate the students' lecture notes with their textbook materials outside of class.

Presenting note-taking as a practical shorthand system oftentimes appears as an afterthought in textbooks; when, in actuality, this system is the most practical and one that most students use already and can be taught how to use more efficiently and effectively. The suggestions are to use standard abbreviations in place of complete words, remove the vowels in words, shorten words, make up symbols, and use standard abbreviations for proper nouns (e.g. w/ – with, lwyr – lawyer, info – information, 2day – today, KS – Kansas). This practical shorthand system leads students who are already using text messaging to automatically take notes like they are texting on their cell phones.

#### **SMS TEXT MESSAGING DEFINITION**

SMS is an acronym for Short Message Service. It was originally defined in 1985 as part of the GSM (Global Service for Mobile communications) series of standards [3]. Today SMS is a synonym for sending a text message regardless of protocol. Estimates are that SMS text messaging involves 2.4 billion active users. That is 74% of all mobile phone subscribers [5].

## AUTHOR DEVELOPED SOFTWARE

Carter, et. al. [1] views note-taking using text messaging as a detriment in that, "...when students take notes in text message 'language,' they may be so accustomed to omitting capitalization and punctuation, using acronyms, and replacing long words with incorrect contractions that they may forget to correct their final work." The authors have worked to overcome this perceived detriment by developing software designed to be used as a note-taking tool using SMS text messaging language, plus the shorthand techniques mentioned above.

The software, referred to as "The Ruby Translator<sup>™</sup>," is designed to convert text messages, abbreviations, symbols, etc. into full text. The students can type their notes directly into The Ruby Translator<sup>™</sup> from their computer [in class might be their laptop or netbook] then click the Translate button and the full text is displayed. The students then click the Export button and the full text is displayed in their default word processor. At that point, the students are able to proofread, edit, save and print their complete notes. If the students wish to take notes on their cell phones, they can create an email message addressed to themselves. They can then copy and paste their email contents into The Ruby Translator<sup>™</sup> for translation into full text. Alternatively, if the students do not have access to electronic inputs, or prefer to take handwritten notes, they can do so in their texting shorthand, and then when they have electronic access can enter their notes into The Ruby Translator<sup>™</sup>. This will give them the added benefit of reviewing their notes, making sure they understand the content.

Texting shorthand consists of over 1,000 abbreviations, which means that for this note-taking system to work, the students must be quite familiar with the texting shorthand. Guides are available on-line that give students hints on how to text faster (See *Texting Faster* as an example) [7]. As well, each area of study has its own acronyms, abbreviations, and specific language. For The Ruby Translator<sup>™</sup> to be more useful and accurate, a Dictionary is included as part of the software that allows the students to add, delete, and edit the texting words and complete text for their specific areas of study or interests. For instance, an MIS major might add ERP – Enterprise Resource Planning, SaaS – Software as a Service, DBMS – Database Management System, etc. to their personal dictionary.

## CONCLUSION

SMS text messaging appears for the time to be sweeping the world with a new language. As university professors we have a choice to complain about the students' using this additional technology or we can embrace the technology and teach the students how to make the best use of it in their learning process. This paper has provided an overview of note-taking systems, defined SMS text messaging, and introduced an author developed software package. While the focus is on student learning in the classroom, these elements can be transferred into the job search and professional workplace. If the students see this as a valuable experience, then their learning will improve. The authors' experiences have been that their students are eager to use texting shorthand and to profit from it with better note-taking and in turn more learning.

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# **ARE WE REALLY GOING GREEN? THE DEVELOPMENT OF A STUDENT CASE USING MULTIPLE REGRESSION**

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## **ABSTRACT**

As a student, I start the new semester armed with my course schedule, course descriptions, straight from the on-line undergraduate catalogue, and the all-important feedback from students who have taken the course and professor before me. Introduction to Management Science (MAN4550) is “the study of selected mathematical and statistical models used to aid managerial decision making.” It sounds fairly intense and potentially boring, but a necessary evil, i.e., requirement. Imagine my surprise when the subject matter is in fact interesting, timely, and very applicable in today’s “green” world. This paper presents the development and analysis of one of the cases in this quantitative course. Are we really trying to reduce our usage of power--electrical power? Topics: time series, seasonality, multiple regression analysis, interrupted time series, and meaningful learning.

## **INTRODUCTION**

Before it became politically correct, many people took great strides to cut down the amount of electricity usage in their homes. Not only are electrical rates going up, but there is a drum beat about destroying the planet and people need to do with less electrical consumption. Faculty are always looking for real world, timely topics with quantitative models attached to their analysis. With data presented by the professor the students are able to develop a model and perform much statistical analysis. This not only taught the students the subject matter, but was application oriented to the point where many students started thinking about the next model building project upon completion of this assignment.

## **RESEARCH GOAL**

The research goal (according to the professor) is to show that the professor really is trying to “go green” and reduce his family’s usage of electricity. It is the students’ assignment to defend or refute the professor’s statement, “I am going green.”

## **VERTICALLY INTEGRATED CASE APPROACH**

Table One presents a list of tasks the students and faculty must accomplish during the six class assignment:

## **TABLE ONE**

### Steps to Perform a Vertically Integrated Research Case

- 1) Statement of the model--the dependent variable (class #1)
- 2) Hypothesize the quantitative model and the relationship of each of the independent variables to the dependent variable (class #1)  
\*It should be noted that the professor “guided” us to the various independent variables as the database was historic and we could not play “Star Trek” and go back in time to collect data.
- 3) “Collect” the data and build the database. This was done by the professor who had data stored on paper at his house.
- 4) Make database available on-line for retrieval and use in an Excel program. (class #2)
- 5) Analyze the data: model validation & statistical tests.
  - a: time series with trend and seasonality (after class #3)
  - b: multiple regression using interrupted time series (after class #4)
- 6) Present student model and discuss results. (class #5)
- 7) Draw conclusions--review hypotheses. (class #6)

### **DEVELOPING A CAUSAL MODEL**

Developing a causal model can be accomplished in a number of ways. A professor can lecture the class about the dependent and independent variables, the equations for predicting the outcome, and statistical measures of the validity and value of the model. Or the professor can create a forum for interaction by asking the right questions, thus leading the students down a path to meaningful learning. Using this method, all students are welcome and encouraged to offer suggestions when asked, “What independent variables will affect electrical usage in a home?” It is a safe question that elicits many “common sense” answers from the class, such as “temperature.” The class and the faculty member enjoy a two-way interchange as opposed to the far less effective one-way lecture approach.

Now that everyone is awake and participating we learn that an independent variable must pass three tests:

- 1) The proposed independent variable must be logical. We must be able to sit back and say, “Yes, that makes sense to me.”
- 2) The proposed independent variable must be quantifiable. I must be able to develop a number to represent the variable value.
- 3) The proposed independent variable must be obtainable. Beyond overcoming the proprietary problems in many corporate databases, I must be able to get my hands around the variable in a timely manner and without spending an arm and a leg. In this case, there is no proprietary, merely availability.



## THE DEPENDENT VARIABLE -- KILOWATT USAGE

The professor presented the dependent variable -- average daily usage in Kilo-Watt hours (KWH's). The limiting factor is the day that the meter is read. It does not happen on the last day of the month. Therefore the practical variable value is the usage from one reading to the next divided by the number of days between readings. That average daily usage is set as the month that encompassed the most days within the one meter reading to the next. All of a sudden students realize that this project is not going to be as simple as they first imagined. Real data collection is not a "class room exercise." The professor explained to the students that twenty years of monthly data are available.

## DISCUSSION ABOUT INDEPENDENT VARIABLES

"Temperature" is a wonderful independent variable. It is logical! How do we quantify it? We could find the "mean monthly temperature." Is the data easily accessible? Yes, the local television station would have that information. Weather.com or the local library would have that information. However, if we consider the data "monthly," wouldn't "monthly" take account of the temperature? Students easily hypothesized that in the state of Florida, electrical usage has two spikes: a) air conditioning demands in the summer months and b) heating requirement in the winter. Therefore, a group of 12 independent/dummy variables are "seasonality/weather" accounting for each month.

It was decided that the first two models would be time series models. First, a simple time series model using only a trend component, hopefully with a negative B-coefficient and a second time series model that includes a trend and seasonal components. Students have studied time series models in previous courses. This course, however, introduces simple and multiple regression. Are trend and weather the only possible independent variables?

"How about additions to the house, increasing the square feet of climate controlled space?" Good One! The professor expanded his house by 700 square feet in 1993. How do we quantify this variable? At first it seemed easy--simply use the square footage of the house before the expansion date and the square footage after the expansion data. Therefore you would have roughly 50 months (observations) at the smaller number and about 200 months at the larger number. That may work. However, the professor wanted us to learn more. He introduced "Interrupted Time Series Analysis." (ITSA)

This is a method used to predict the value of a dependent variable when there is one or several known critical events that greatly affect the value of the dependent variable. ITSA is an application of ordinary least squares multiple regression or a form of piece-wise regression since we are evaluating the dependent variable over at least two different pieces of time--a "pre" period leading up to the event, and a "post" period following the event.[4] The technique may be partitioned into more than two pieces if there are other significant events. ITSA estimates the trend line of the performance measure--daily KWH usage--in the pre-event period (pre-house expansion) and assumes that the trend should change in some way after the event. Coleman and Wiggins [2] use an application of ITSA in assessing a damaging event in a

litigation case, 1986. \_\_\_\_\_[3] uses ITSA in a paper to predict stock prices, 2002. There are many application possibilities.

This insight ignited the students’ imagination. Some “critical event” that changes electrical usage.....a baby! Good One! In November, 1994 the professor’s family size expanded from two to three.

Did you explicitly do anything to show the world you are “going green” a student asked. The professor did replace an aging central heating/air conditioning unit (two heat pumps, actually) in December, 2003. According to the Heating/AC Company, the new systems would greatly reduce electrical usage.

The number of independent variables have grown greatly--one for time, 12 for the 12 months in a year, two for each of the three critical events, for a total of 19 independent variables. Although students knew they would not have to create the database, students knew the poor professor would be doing the work. Therefore the class unanimously decided to stop at 19 variables.

**HYPOTHESES CONCERNING THE INDEPENDENT VARIABLES**

Before leaving the professor to his database building (huge) job, the class hypothesized the relationship between the dependent variable and each of the “groups” of independent variables. These are listed in Table Two.

**TABLE TWO**

Independent Variables and Hypotheses

<u>Independent Variable #</u>	<u>Independent Variable Group</u>	<u>Hypothesis(increase/decrease)</u>
1	Time	Decrease (going green)
2-13	Seasonality(temperature)	Bi-Modal Sine Curve
14-15	12/93 House addition	Increase
16-17	11/94 Baby	Big Increase
18-19	12/03 New AC/Heat Units	Decrease

**IMPORTANCE OF USING INTERRUPTED TIME SERIES**

Using a time series, even with the addition of seasonal indexes, most likely will reveal a positive B-coefficient. That would defy the statement that the professor is going green. However, students believe that this can be explained because of the addition to the house and the addition of the baby. There would be no way to overcome those increases by trying to go green. If we can mathematically account for these critical events, the overall hope of a “greening” house is possible.

## A FIRST MODEL -- A SIMPLE TIME SERIES WITH TREND

The class is prepared to start the analysis process. Actually, the students are very excited to see if the “greening” was real or only “hoped for.” The data, all 240 months is stored at the professor’s home. After the data file is constructed, students can access the information from the classroom database. Table Three presents the statistical analysis for the trend model.

**TABLE THREE**

Trend Model of KWH Usage per Day

B-zero	52.46361 kwh
B-one	0.009537 kwh/day
Standard Deviation	13.50088
R-square	.002409
F-statistic	0.449
T-statistic	0.758

The trend model is not very statistically significant and thus, not a good predictor model. The B-one is positive and thus the usage is growing over time--not what we wanted. However, the number is very small, only about 0.03 KWH increase per month ( $30 * 0.009$ ). Given the accounting for the critical events, the B-one may turn negative signifying that the professor is “going green.” Hopefully, with the addition of more important independent variables, the R-square will improve.

### ACCOUNTING FOR SEASONALITY

Seasonality in a time series model is straight forward. Seasonality in a multiple regression is far more complicated and takes several steps. The steps and results are described below.

Step 1: Develop a matrix of 11 dummy variables--January through November--for this case. There is no December dummy variable. Thus when the computer calculates the B-coefficients for each of the eleven months, that figure is the difference between the particular month and December. For example, the July index from the computer program is 22.56892. This means that the usage of KWH in July is 22.56892 (per day) more than in December. Thus to calculate the additive seasonal indexes so that we can talk about the usage in July relative to July, more steps are required.

Step 2: Add up the values of the eleven B-coefficients, January through November. For this case, that summation is 120.37302. The 12th month, December is given a seasonal index value of 0.0. Divide this summation by the 12 months. This average is 10.031085.

Step 3: Subtract 10.031085 from each of the twelve seasonal indexes (11 from the computer output plus December) and add 10.031085 to the B-zero value (42.4872).

Table Four presents the numerical results of the above three steps and the statistical measures from the computer output.

**TABLE FOUR**

A Second Model that Considers Trend and Seasonality

<u>Measure or Variable</u>	<u>Trend &amp; Seasonal Model</u>	<u>Trend Model</u>
B-zero	52.5180	52.46361 kwh
B-one	0.009083 kwh/day	0.009537 kwh/day
Standard Deviation	8.50722	13.50088
Adjusted R-square	.602237	R-square = .002409
F-statistic	31.155	0.449
	<u>Seasonal Index</u>	
January	0.464335	
February	-0.781751	
March	-5.884834	
April	-15.098417	
May	-12.79900	
June	0.129915	
July	12.537835	
August	16.845755	
September	16.549665	
October	6.228585	
November	-8.151002	
December	-10.031085	

The results are significant and impressive! The B-zero and B-one coefficients barely changed. That is expected. The R-square for the seasonal model is greatly improved at 0.602. The absolute need for seasonal indexes is validated. The bi-modal hypothesis about the seasonal electrical usage in Florida is confirmed. Troughs in March through May and November through December. Peaks in January and July through September. However, the “going green” has not changed. According to the B-one coefficient, we are not going green.

The next step is accounting for the three critical events presented in Table Two. Students decided to add one critical event at a time. Further, they decided to add them in chronological order, starting with the house expansion.

**USING INTERRUPTED TIME SERIES -- GENERAL MODEL**

Each critical event requires the addition of two independent variables. The basic model is developed from the model used in Coleman and Wiggins [ 2 ].

$$\begin{aligned} \text{Dependent Variable} = & B(0) + B(1) * \text{TREND} + B(2, 3, \dots, 12) * \text{DUMMY} \\ & + B(13) * \text{SHIFT} + (B14) \text{TRCHGE} \\ & + B(N) * (\text{two more sets of shift and trchge}) \end{aligned} \quad (1)$$

Where:	Dep. Var	is the KWH usage per day.
	TREND	is for the time series variable.
	DUMMY	is for the matrix of 11 dummy variables for the months or the seasonality + December calculated from output regression information.
	SHIFT	is the change in usage due to the critical event. SHIFT = 0 for all pre-event months and event month. SHIFT = 1 for all post-event months.
	TRCHGE	is the change in the trend component due to the effects of the critical event. TRCHGE = 0 for all pre-event months and the even month; TRCHGE = 1 for the first post-event month; TRCHGE = 2 for the second post-event month, etc.

There are three sets of “Shift and Trend Change” variables due to the three critical events. During the next phase of the research, each critical event is tested separately and in chronological order. The students hoped to confirm their hypotheses about the critical events as presented in Table Two. Table Five presents the results. Each multiple regression model includes the trend, the seasonality, and one of the critical events.

Two of our hypotheses are validated. It is surprising to both students and faculty that the B-coefficient for the addition of the baby is smaller than the addition to the house. So be it! The positive B-coefficient for the new heating/air conditioning central units is shocking. The installer promised that the efficiency and thus the less power usage would be significant. However, the B-coefficient is a larger positive than the B-coefficient for the baby. The professor said, in slight disgust, that it would be a little late to go back to the seller and demand a refund for false promises.

### **TABLE FIVE**

#### The Addition of Each Critical Event to the Model

<u>Additional Event Individually</u>	<u>B-one “going green”</u>	<u>B-coefficient of critical event</u>	<u>B-coeff. change</u>	<u>Adjusted R-square</u>
Multiple Regression (no critical events)	+0.009083	-----	-----	0.6022
House Addition	-0.12344	6.377	0.1196	0.609
Baby	-0.02676	3.884	0.0205	0.6042
New H/AC Unit	-0.00629	5.592	-0.0663	0.6079

With all that said, the celebration started with the new B-coefficients for the “going green” variable. With all three significant events considered individually, the B-coefficient is now a negative in all three models. The professor has continually decreased electrical usage with respect to original usage twenty years ago. The students are amazed because in the past twenty years the number of new retail/consumer items available that consume electricity has increased tremendously. Personal computers were few and expensive twenty years ago. Now every house has a couple, especially a research professor. DVD players, CD recorder/players, microwave ovens, big screen television sets all consume electricity.

### **COMBINATION OF THE CRITICAL VARIABLES**

The next task is to look at the models that include combinations of the critical events. First each two event combination is evaluated and finally, all three critical events are included in a final model. It is hoped that in the final model, the original hypotheses may be confirmed.

The first observation is that the B-coefficients on going green are all negative. This can be interpreted that over time and with all other things equal, the professor is “going green.” Three of the models in Table Six show that the reduction in KWH usage is about 0.12 KWH per day or about three and one-half KWH per month. This is not a huge number, but over 240 months, it is a sizable reduction. The B-coefficients on the critical events, however, are not so easy to interpret. Actually, they seem opposite of our hypotheses. This is frustrating. Most of the t-statistics of the various variables over all of the models are statistically significant at the 0.10 level. That is reasonably strong, but not “pounding the table” strong. The adjusted R-square for all of the models is 0.6+ and very similar.

### **TABLE SIX**

#### The Combination of Each Critical Events to the Model

<u>Additional Event</u>	<u>B-one</u> <u>“going green”</u>	<u>B-coefficient</u> <u>of critical event</u>	<u>B-coeff.</u> <u>change</u>	<u>Adjusted</u> <u>R-square</u>
House Addition + Baby	-0.12208	-7.1449 -9.57289	2.2599 -2.144	0.6176
House Addition + New H/AC Unit	-0.12421	8.7379 7.7547	0.06835 -0.1715	0.6237
Baby + New H/AC Unit	-0.02711	6.760 8.512	-0.04839 0.00273	0.6225
Multiple Regression + (three critical events)	-0.12285	-----		0.636
+ House Addition		-7.080	2.2121	
+ Baby		-6.515	-2.1639	
+ New H/AC Unit		8.425	0.00253	

### USING THE MODEL

The final step is to use the model to predict electrical usage for the next month, September, 2009 using the combined model with all 19 independent variables. The monthly seasonal indexes must be calculated for the combined model. Equation (2) is used to calculate KWH usage per day.

$$\begin{aligned}
 \text{KWH/day} &= 54.6345 - 0.12285(241) + 16.3485(1) - 7.08(1) + 2.2121(189) \\
 &\quad \text{B(0)} \quad \quad \quad \text{Trend} \quad \quad \quad \text{September} \quad \quad \quad \text{House Addition} \\
 &\quad -6.515(1) - 2.1639(178) + 8.425(1) + 0.0253(69) \quad \quad \quad (2) \\
 &\quad \quad \quad \text{Baby} \quad \quad \quad \quad \quad \quad \text{New Heat/AC} \\
 &= 69.293
 \end{aligned}$$

Using the multiple regression model presented in Table Four that includes no critical events, the KWH/day is calculated as:

$$\begin{aligned}
 \text{KWH/day} &= 52.5180 + 0.009083(241) + 16.549665(1) \quad \quad \quad (3) \\
 &\quad \text{B(0)} \quad \quad \quad \text{Trend} \quad \quad \quad \text{September} \\
 &= 71.248
 \end{aligned}$$

### CONCLUSION

The time had finally come to wrap it all up. As a class we had come a long way. The goal of learning was reinforced by the process of discovery. When everyone is involved in building the

model, meaningful learning becomes a more pleasant experience. The interaction of the students, the professor, and the database itself made the project interesting and engaging. We are not spoon fed a sterilized, meaningless, laboratory tested batch of data from a textbook.

Somehow, we all are invested in the project and the enthusiasm for the subject infected the entire class. We performed our analysis of the data and learned that real data does not always come easy or have simple conclusions. Our hypotheses were not always validated which was very frustrating. Finally, even though it was challenging material, we managed to have fun with it! Here are a few reasons why this case is such an effective method of learning:

- 1) The data is real and timely.
- 2) The situation is realistic and not just a “classroom exercise.”
- 3) Students are encouraged and expected to interact throughout the case.
- 4) The computer is used extensively
- 5) Sophisticated models are developed using the computer.
- 6) Many steps are needed to reach a conclusion.
- 7) There is not one clean, final answer, thus reinforcing the “real” idea of the case.
- 8) The students enjoyed the realistic and far-reaching discussions.
- 9) When it makes sense, it sinks in!

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## **SEDSI Panel: Team Teaching:**

### **Benefits and Rewards for Students, Faculty, and Administrations**

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## **OVERVIEW**

This panel discussion will explore the logistical and pedagogical hurdles common to team teaching as they might affect students, faculty, and administrators. At first glance, team-teaching presents opportunities for students and faculty to gain from a collaborative academic effort, but it also requires a significant amount of coordination and, to some extent, a potential loss of autonomy for the faculty members involved. Students gain from multiple points of view, but are potentially confused and distressed by grading issues and inconsistencies in expectations among their faculty. Administrators face the challenge of determining course loads and compensation structures as well as interpreting assessment results that may differ substantially from traditional classes. The format of this panel will have four components: an overview, case studies from faculty, administrator responses, and a Q & A session.

## **LITERATURE REVIEW - TEAM TEACHING**

There exists a substantial base of literature on the topic of team teaching, defined as ‘any model under which two or more faculty members share some level of responsibility for delivering course content, classroom management, and/or the assessment of student work and

assignment of grades. Collaborative teaching can be categorized into one of five types, where the last three are generally referred to as Team Teaching.

1. The Star Team where one faculty member is responsible for the class and invites others to provide lectures and course content (also called the master-teacher model).
2. The Hierarchical Team where a senior faculty gives lectures while junior faculty or teaching assistants lead discussion groups.
3. The Specialist Team where two or more faculty jointly design the course and divide presentation topics according to expertise.
4. The Generalist team –where teaching responsibilities are divided based on time schedules or factors other than expertise.
5. The Interactive team – all team members are in the class all the time, and share responsibility for the class. (Austin & Baldwin, 1991 pp. 36-37)

Examples appearing in the literature demonstrate the trade-offs implicit in team teaching and note that the benefits often dominate. In particular, sharing past experiences and best practices among participating faculty can provide an efficient means of training. Further, team teaching offers valuable opportunities for team-building among peers, and/or establishing mentoring relationships. (Booth et. al., 2003; Leon & Tai, 2004; Wenger & Hornyak, 1999; Zhang & Keim, 1993). Additional benefits can accrue from the inherent efficiencies generated by well-designed team-taught classes; for example, faculty may be able to re-allocate resources (largely measured by time) to other pursuits (Booth et. al 2003).

The costs associated with team teaching cannot be understated. A first requisite is an established common goal, shared by the participating faculty (Booth et. al 2003; Wenger & Hornyak, 1999; Zhang & Keim, 1993). This goal, and those that flow from it, must be clearly enunciated in the course syllabus to communicate the expectations of both the student and teaching faculty (Nead,1991; Zhang & Keim, 1993). In support of the goals, a clearly defined schedule of class time utilization and course work submission dates must exist (Booth et. al.,

2003). Unambiguous grading and evaluation criteria as well as a clear chain of command are required (Booth et. al., 2003; Durcan & Kirkbride, 1987; Nead, 1991; Silver et. al., 1996; Wenger & Hornyak, 1999; Zhang & Keim, 1993).

Finally, faculty (and administrators) must recognize the significant time required to plan and execute an effective team taught experience. Many hours are required to effectively create such a course, but many more are needed to maintain the continuity and quality of instruction as mid-course changes are encountered. The good news is that after several iterations, the maintenance time reduces significantly (Booth et. al., 2003; Durcan & Kirkbride, 1987; Nead, 1991; Silver et. al., 1996; Wenger & Hornyak, 1999; Zhang & Keim, 1993).

### **GOALS AND OBJECTIVES OF THE PANEL**

The goal of this panel is to provide an overview of methods which overcome the common failings of team taught courses at the collegiate level. The target audience is any faculty member interested in developing or improving a team-taught course. In addition the session intends to reach administrators seeking guidance in evaluating the workload or work product of the faculty and students in team-taught courses, or those seeking to counsel faculty in the current best practices. The panel session's agenda is as follows:

- An Introduction:
  - General definitions
  - Trade-offs
  - Strategies to optimize benefits
- Case Studies:
- Issues
- Q & A session and wrap-up

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## **PRECURSORS FOR LEADERSHIP:**

### **LOOK, LISTEN, LEARN, LOVE AND LAUGH**

**Sheila Foster, Al Lovvorn, Frank Morris, William Sharbrough, and W. Earl Walker**

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## INTRODUCTION.

Opinion polls and media stories report that distrust for leaders is at an all-time high. Employees report holding their executives in low regard. Rapidly declining stock market values reflect distrust of corporate leaders and their accounting systems. Government leaders are also deeply mistrusted. Indeed, it appears that distrust is eroding our capitalist and democratic systems.

What can executives do to restore trust and lead more effectively? Indeed are there any measures that will help executives engage their associates more effectively and move their organizations forward.

The composite experience of the authors is extensive; we have led in the corporate and not-for-profit sectors, the military, the government, and academia. And we have concluded that there are five precursors for leadership, simple rules that can help any leader move forward and win the trust of the many stakeholders that surround all organizations.

The initial impetus for our ideas grows out of a conversation one of us had as a business school dean with a corporate leader in Kansas City. As all business deans do, he was out meeting executives and seeking ways to serve them effectively. This executive stated his thesis quite simply: “Leaders must first listen and learn before they can lead.” Building on this very simple insight, we have concluded that there are in fact three other precursors to leadership: look, love, and laugh. Our insights here grow out of our own experiences: we have all had leadership roles; we have relied on mentors who have coached us; we have served as mentors; and we have learned from executives who served as guest speakers to our graduate and undergraduate classes. In addition the over 300 executives, who have served on The Citadel School of Business Administration Advisory Board and The Citadel Mentors Association, have been a source of ideas and inspiration. These insights are further reinforced by the extensive leadership literature that has built up over the last decade.

We are reminded of a comment made by Sergio Marchionne, who began the successful revival of the Fiat Group in 2004: “My job as CEO is not to make business decisions – it’s to push managers to be leaders [Marchionne, 45].” And pushing managers to be leaders seems to be the story of our age. As Marchionne notes in his article, he had to look and listen to find leaders, he had to learn from them, and indeed he had to love them. As his article also suggests, he also has learned to laugh: “I couldn’t possibly expect people in Italy to start singing the company song every morning as if we were a Japanese plant [Marchionne, 48].”

In this article we will first review our five precursors to leadership. Thereafter we will amplify on them section by section to augment them with our experiences, with stories heard from guest speakers in our classes, as well as the literature on leadership. Finally, we will conclude with a number of propositions about leadership growing out of what we have learned.

### Precursors to Leadership

To build trust, one must first learn about the organization. To learn is to look and listen. Trustworthy leaders spend a lot of time looking. They visit employees' offices, watch colleagues at work, and seek to understand what people in the organization actually do on a daily basis. They watch them as they ask questions – as is clear from the communication literature, body language is usually more revealing than content. Indeed as all military officers know, leaders must spend time visiting the troops. Many things about such visits are revealing: employee work conditions, pictures and certificates on walls, and colleague

interactions with others.

While they are looking, leaders should also listen. The art of listening has two components. First, leaders need to ask questions of employees [DeLong, et.al. 16]. Such questions might be: “What is your job here?” “Who do you report to?” “What are you hearing about the organization from fellow associates, other divisions and corporate headquarters?” “Where do you gather information?” “What are your objectives and when do you expect to meet them?” “Why are some directives not being followed?” And “how effectively are organizational systems working?” Second, listeners also keep their airtime, or the time they actually talk, to a minimum. Employees are reluctant to talk if they have to compete with executives who are more interested in telling than listening.

As they look and listen, leaders learn. Learning of course goes much beyond time spent with others. Clearly leaders must spend a great deal of time reading and absorbing the history, culture, norms, and idioms of organizations, all of which are in a fog of near constant change. To borrow from one of our guest speakers in our MBA leadership course, the best leaders recognize that they actually know very little about their organizations. Thus, they follow Max DePree's injunction to "abandon themselves to the strengths of others [DePree, Leadership Is An Art, 89]."

What also stood out most prominently about the leaders who visited the Citadel leadership course is that love is a central condition for leadership. To be sure, love is not usually a term that comes to mind when thinking of corporate executives. Love is often expressed in other terms: passion, respect, caring and appreciation. One leader was asked why he had been selected as CEO of a highly successful company over many Harvard-trained MBAs. He said nothing, turned to the blackboard, and in big bold letters wrote the word: "PASSION." He went on to explain that he was passionate about the company's employees, its customers, and its products.

He was not alone. Still another visiting lecturer who had started as a collection agent in his company while in college and later rose at a young age to be CEO – picked over others who had much more seniority – noted that he loved everything about his organization, and he loved going to work. Virtually all successful leaders love their jobs. They love the excitement jobs provide. They love their organization and all its stakeholders. They respect their employees and customers. And this love, passion, and respect demonstrate very clearly to all employees, stockholders, customers, elected officials, regulators, and the news media.

As Daniel Goleman and his colleagues have taught us, effective leaders establish resonance with others [Goleman, et.al., 5 and 19-31] That is, they develop an emotional relationship with those they lead. When they do so, people are willing to follow them. And one of the best ways to establish resonance is laughter or humor. It bonds people together and builds trust.

Many leaders clearly admit they are not good at jokes. What they are often very good at is telling funny stories about their own behavior. They seem to enjoy poking fun at themselves, a technique that engages followers and reminds them that leaders are human too. For example, at one MBA class, one of us lost track of the time and sought to keep students an extra hour one evening. They were quick to correct him! He won many smiles during the rest of the course by pointing out that he was indeed the absent-minded professor, unable to even tell time.

We contend that people will follow only those they trust. Trust and leadership are inseparable. To establish trust, one must look, listen, learn, love, laugh, and then lead. Executives must act if we are to recover the trust so essential for American way of life and capitalism. As an old aphorism goes, "Your actions speak so loudly, I can hardly hear you!"

### **LOOK.**

To borrow (or modify) the words of Yogi Berra, "You can observe a lot just by watching." And, leaders can *learn* a lot just by following Yogi's advice.

As explained by one of us who has led a company, "Observation is one of the primary ways in which we gather information. It can involve deep study; but more often observation happens while other things are going on – it is an activity that continues during all of our waking hours. Through observation, the leader garners not only the obvious, but also the nuances and ambiguities that are often vital inputs in making good decisions."

But, even the simple task of observing (i.e., looking), can be more difficult than it seems [Heifetz and Laurie, 6-7]. The challenge can be summed up in the old adage, "We look, but we do not see." To be successful at looking, leaders must look with their eyes and minds wide open. That is, leaders should have a plan and a purpose for looking, and they should devote a good bit of time to practicing the art of looking effectively [Thomas, 9].

This idea of leadership looking, as a part of what leaders do, has long been a requirement in the military. As all military officers know, leaders must spend time visiting the troops. From the perspective of one retired Army Colonel, "In the Army, all combat leaders are expected to be at the front with their troops, living the life that they endure, watching them in action, and discovering their strengths and weaknesses. That is, platoon leaders of 35 soldiers, company commanders of 120+ soldiers, battalion commanders of 600 soldiers, and brigade commanders of 3,000 soldiers are all expected to be in the field watching their soldiers and helping them accomplish their mission."

But what happens when we try shifting the concept of 'leadership looking' from the battlefields to the boardrooms? How do corporate leaders visit with their troops? One of us has observed the following in visiting hundreds of executives, "Corporate leaders can look by visiting employees' offices (that is, not asking employees to come to them), watching employees talk with and interact with each other in groups and individually, and seeking to understand what people in the organization actually do on a daily basis. Many things about such visits are revealing." In short, the same principles for effective looking apply no matter what type of organization is involved.

### **Being Visible**

In their bestselling book In Search of Excellence, Tom Peters and Bob Waterman popularized the Hewlett Packard philosophy described as "Management By Walking Around," or MBWA [Peters and Waterman, 289]. This philosophy could just as correctly be described as "Leadership By Walking Around," since the idea involves leaders visiting with their co-workers in their co-workers' offices. An important, but sometimes overlooked, benefit of Leadership By Walking Around is that, not only does the leader have the opportunity to observe his co-workers, but those co-workers also have the opportunity to observe their



leader. For example, David Ogilvy, CEO of the company Ogilvy & Mather, shares, “Do not summon people to your office—it frightens them. Instead, go to see them in their offices. This makes you visible throughout the organization. A leader who never wanders about his organization becomes a hermit, out of touch with his staff.” [Peters and Waterman, 289]

Ed Carlson, former CEO of United Airlines, further describes the importance of getting out of the office and being visible in the organization, “One of the problems in US corporations is the reluctance of the top leadership to get out and visit with employees...even when it involves listening to criticism. There’s a tendency to become isolated; to surround yourself with people who won’t argue with you. You hear only the things you want to hear within the company. When that happens, you are on your way to developing what I call corporate cancer [Peters and Waterman, 290].”

### Being an Example

A key benefit of leaders getting out and being visible is the opportunity to lead by example. “Leaders implement their visions and behave persistently simply by being visible. These leaders believe, like an evangelist, in constantly preaching the ‘truth,’ not from their office, but away from it.” [Peters and Waterman, 288].” One retired Navy Commander, explains, “The act of looking is not only watching what your people do, but also allowing your people to watch what you do—to set an example that they look to emulate because it engenders a sense of belief in something achieved through the efforts of all within the organization.”

The Commander went on to share a personal experience:

As a young officer newly reported to my ship, the Commanding Officer took me, as he did all newly reported officers, on a brief walk about the ship concentrating especially on the areas for which I was specifically responsible. He was a great deal senior to me and remained professional, but polite, and carried the conversation. I’m sure he remembered the trepidation that many newly reported officers felt upon having to do a tour of their spaces with their Commanding Officer for the first time. Through the wisdom gained from experience, Commanding Officer’s eyes were always assessing what we passed as we carried on our conversation. He was unfailingly polite to the sailors who were working and made a point to speak to each one. Here and there, when we stopped to speak with a sailor, he would point out something that needed more attention, and then he and I moved on through the spaces.

As we ended our walk together, he asked what I had seen and learned. Having previously served on a ship, I felt I knew the answer and quickly responded with the old Navy quip, “You get what you inspect, not what you expect.” I still remember him stopping me and saying that while my response was true, the most important thing to remember was that as a leader you are always in front of someone who sees you—who looks to you—and when you walk by something that is not right, no matter how small, and you fail to get the matter corrected, you have now set a new, lower standard. People want to see where your standards are and when you allow something to slide because you are too busy, too tired, too distracted, or committed only verbally, they see a new minimum standard because the leader looked the other way.

One of the guest speakers to our MBA leadership course observed that as a senior executive at DuPont, he found early in his career that all leaders in the corporation were expected to visit with employees often. Furthermore, the organizational ethos was that leaders were expected to correct mistakes on the spot as they

observed them in their visits. It was accepted at DuPont that if a leader saw something wrong and did not correct it on the spot, then the leader had essentially accepted that behavior as satisfactory.

Because leaders are constantly setting an example through their presence, their words, and their actions, leaders must learn to correct mistakes on the spot while they are out looking around the organization. However, it is equally important for a leader to learn how to correct *correctly*.

### Correcting and Applauding

When making visits to an employee's office, a good rule of thumb is 'don't be critical.' "When you witness a performance gone wrong, don't criticize the performer. Correct on the spot anything that must be redone, but wait to speak to the wrongdoer's supervisor to bring about corrective action ("Twelve Guidelines")."

When visiting with an employee, the leader should come prepared to make a concerted effort to catch the employee in the act of doing something right. In this case, the leader is consciously looking for something positive. In our own families, we see this as we strive to lead our own children. When a child comes home with a report card with an assortment of "A" and "B" grades and one lonely "D", how often will we focus attention on the "D" before praising the higher grades? As we have learned, "The idea is to look for victories rather than failures. When you find one, applaud it. When you run into one of the many unsung heroes in your job site, thank them on the spot, being careful not to embarrass them in front of peers or to leave out other deserving employees ("Twelve Guidelines")."

### Looking Builds Trust

The leader's goal in *looking* is to stay in touch with the people she leads by observing them and giving them the opportunity to observe her. By visiting with her employees on a regular basis, she begins to identify where they are succeeding, where they are struggling, and where they need help.

A natural and very beneficial byproduct of this technique is a relationship of trust that builds over time between the employees and the leader. When the leader is doing a good job of *looking* effectively in the organization, the employees will feel that their leader knows what she is doing, and she will have a better rapport with her employees.

## LISTEN.

Listening is one of the four communication skills—reading, writing, speaking and listening. Leaders use all four. The question is, "Do we listen as well as we do the other three?" We are trained to read, give speeches, write memos, prepare presentations, and write to influence others. However, we are rarely trained in listening, especially to our followers.

It is also important to remember that followers' messages are much more than the words they say [Katz, 38]. Leaders really need to hear and understand the tone of voice, eye contact, body language, and all those other non-verbal cues that help leaders really hear and understand what followers are saying. Such cues play a central part in the messages followers send [Darling and Walker, "Effective Conflict Management," 237; Welch, A 14].

One of us offered the following on the importance of listening as a part of effective leadership: he asked a friend, who was an experienced leader in a variety of positions in volunteer organizations, for advice in dealing with a trying period at the office where internal bickering was bedeviling his organization. She suggested that "perhaps you are not listening to what concerned everyone in the group." She observed that in every large group friendships, cliques, and individuals with close relationships tended to band together whenever there was free time. In her case, groups of her employees often had planned lunches once a month. She made a point of eating with a different group each month. While joining the conversation of the group, she was actually listening to what they discussed. Over many months, she was able to discern the concerns, perspectives, and thoughts of the myriad groups as they interacted with their friends in a relaxed setting. This interaction, this quiet listening, allowed her to guide the group in cooperation with one another towards the organization's business goals.

A leader leads best when he takes time to listen to multiple viewpoints and understands the concerns of all members of the organization, not just a select few trusted advisors [DePree, Leadership Is An Art, 102]. Hearing and understanding all viewpoints help a leader sustain cohesive teams and foster trust in the decisions the leader has made.

It is safe to say that listening is one of the most important leadership skills, since leaders who don't listen to followers only get told what they want to hear rather than what they need to know [DeLong, et.al., 28; Thomas, 9]. Too often followers are hesitant to speak out, because the costs for such behavior can be unpredictable. Stated differently, when leaders don't listen, followers learn not to say anything or to say only what the leader "wants" to hear [Goleman, et.al., 133] History and fables are replete with examples of leaders who failed to listen to their subordinates. To mention only a few examples, the ignored messages from subordinates leading up to the bombing of Pearl Harbor; the leaders who would not listen to the worker who warned about frozen O-rings in the Challenger space shuttle disaster; and messages leading up to the 9/11 bombings that were ignored by superiors. Maybe the old fable of the "emperor who had no clothes" has more meaning than many of us care to admit.

During his leadership as an executive and co-owner in a business, one of us found that his most difficult tasks, but by far one of the most valuable, was the seemingly simple act of listening to co-workers...really listening. As leaders, we are shouldered with the responsibilities of making decisions, guiding others, and ultimately achieving success for our organizations. Thus, at least part of the problem with leaders and listening stems from the fact that most leaders generally feel compelled to say something in every setting

[Chiquet, 30; DePree, Leadership Is An Art, 101-108; Bolman and Deal, 178; Zucker, April 2, 2009]. They feel it is a part of their job to speak, and if they are quiet too long, they won't appear to be leading. Leaders often feel that they must respond immediately when, during the course of listening to a co-worker, points are made or questions are asked that seem to demand correction, clarification, or explanation.

Many leaders begin to listen sincerely, but become distracted when some comment from a colleague sends their minds racing in another direction as they mentally begin to prepare their response to some comment that grabs their attention. As several of us have found, our greatest temptations were to break in during the middle of a co-worker's comments before we lost our trains of thought and the responses we wanted to make. Over time, we have learned that co-workers can be a valuable source of information, ideas, and feedback for leaders if we only are willing to wait and listen to them.

Clearly listening also suggests that leaders must do more than simply listen; they must learn to listen effectively [Bennis and Nanus, 80]. Leaders must make a concerted effort to focus on the other person's words if they are to listen sincerely and successfully. One suggestion is that carrying a note pad and jotting down a note for a later response can quiet the desire to break in with a comment. This allows the leader to stay quiet, minimize the distraction, and quickly refocus on listening to what is being said. If a leader doesn't fully comprehend a comment, it is OK to ask someone to restate or clarify what was said. In fact, this is a valuable tool to help demonstrate the leader is listening and is genuinely interested in what the follower has to say.

As an elementary school teacher, one of us actually taught "listening skills." Topics included active listening—concentrating, listening to understand rather than preparing a response, trying to understand the message from the other's point of view, and listening for the message behind the words. So many of us instantly step in to help solve the problem of a follower or colleague before we listen for the facts, only to find the real problem lies beneath the surface of the one being presented. In some cases, the follower may not be looking for a solution but just wants a listening ear. Good leaders should listen more and talk less. To be more specific, one of us was trained as a master facilitator and learned that facilitators keep their air time below 40% of all the conversation; this seems a good rule for leadership. In fact, maybe a better percentage is 30%!

Listening is especially important when leading volunteers. One of us found listening to volunteer assistant scoutmasters as well as the boys was critical to the success of the mission, whether planning and executing tasks such as hiking trips for the boys, preparing training programs, and making presentations at meetings. If the troop leader doesn't take Scouts leaders' and the boys' opinions and experiences into account, those volunteers and their sons will probably soon leave the program. Further, the assistant scoutmasters many times worked more closely with the boys and understood their needs better than the leader. Listening to those volunteer assistants helped deliver a more effective program. This applies to other kinds of organizations as well.

It is also critical to listen to all volunteers and employees who all might be considered customers of the organization or the volunteer program. Running these entities calls for a program all can buy into. The input of all stake holders is needed to have interesting, effective, and efficient meetings. In the Boy Scouts, the boys should plan meetings they can present themselves as well as planning and executing camping trips. In Rotary one of us found that by asking the whole Board to help plan the upcoming year ensured that dramatic progress was made. Such a conclusion also applies to all organizations, whether compulsory or voluntary ones. If leaders fail to hear what their followers are saying or want from them and the organization, pretty soon there will be no employees or volunteers.

Several of us have served as academic administrators; we have found that listening to faculty is necessary to deliver the kind of quality education students need. Faculty members are more expert in many of their disciplines than we were. If we did not listen to their inputs, mistakes would lead to dissatisfied faculty and disgruntled students. Additionally, faculty, just like other employees, feel undervalued and dissatisfied when their leaders don't listen. These feelings can lead to turnover and burnout, thereby affecting the quality of the organization, its programs, its products, or its services.

One of us worked closely with the CEO of a Wal-Mart subsidiary with earnings of \$5 billion. This CEO was a particularly effective listener, who would frequently leave his office and visit with employees, many of whom were not his direct subordinates. Reaching down two or three layers in the hierarchy, he would constantly query employees about their jobs, their progress, and the challenges they were facing. He attributed his skills as a listener to his experiences as an Army officer and from his mentor Sam Walton, with whom he had worked closely over a number of years. The organization he led grew over \$1 billion in revenue during his three-year tenure as CEO and instituted an extensive development and training program that brought wide recognition from both employees and Wal-Mart headquarters. In fact, he moved on to lead a major division at Wal-Mart after his brief tenure at the subsidiary. Once again, we can see that listening pays off in both increasing organizational effectiveness and aiding career success for leaders.

While there are a number of tips that can help us become better listeners, the bottom line is effective listening requires sincere effort, intense focus, and constant attention [Covert and Satterstein, 24]. The good news is that the discipline and effort leaders put into listening effectively can provide abundant rewards. If we, as leaders, can learn to listen effectively, not only do others sense that we are sincerely interested in what they have to say, but we can acquire some of the most useful and valuable information available to us in our roles as leaders.

In short, leaders who listen make better decisions and have more dedicated and committed followers. The bottom line is that leaders who listen are trusted by their followers, are able to tap into the combined knowledge and experience of others, and are more effective in accomplishing both their own and the organization's objectives.

## LEARN.

Some individuals seem to be born to be great leaders. History is replete with tales of the singular individual who rose to meet the challenge of the day and led others to accomplish what seemed nearly insurmountable. In fact, early research on leadership sought to find the characteristics of the great leader who emerges in times of need so that great leaders could be identified early. Yet, the fallacy of searching for the great leader as defined by a checklist of characteristics has been replaced with a recognition that great, and even good, leaders are individuals who have developed their leadership talents, because they know how to learn [Thomas, 3-5 and 17-58; DePree, *Leadership Jazz*, 222-223]. Leaders who are successful are those individuals who have spent time thinking and understanding, that is learning about themselves, about the people, the organization, and the situations that confront them. And they know that learning is not a one-time event but rather a continuous process.

As one executive told our MBA leadership course, he is constantly reading, even though he is retired from one multi-billion dollar organization and now chairman of another (that he played a central role in rescuing). In fact he is such a reader that his wife has bought him a statue of a frog! The frog is shown lounging on a chair with an umbrella overhead and a book in his hand! He has implied that his wife is a bit of a long sufferer with his relentless reading habit.

Having risen to a position of success, leaders too often to talk too much and make statements rather than listen to others and ask questions. Leadership is a learning process and good leaders are aware that they can easily slip into this habit as people look to them for direction. From this recognition, good leaders combat this tendency to direct others by seeking trusted advisors or mentors who forthrightly tell them that they are insensitive. And this insensitivity may lead to the loss of fidelity in information moving up to the leader, stop good ideas from others being voiced, and result in less than optimal performance of the organization going forward.

Being in charge frequently results in the leader learning humility. In leading others you learn your own weaknesses. Confronting and surmounting those weaknesses is the act of a leader learning to lead. The recognition of a personal weakness may come at any time; however, the forthrightness to address it denotes the leader in training—one who is determined to learn from the weakness and transform it into a strength.

We five have learned that another way to learn is to meet fellow workers. Rather than passing those see but do not know, we should stop, introduce ourselves, and ask how day is going. New relationships are not things to dread; they are to be embraced. Great leaders take time to learn about those around them. This learning provides insight into why others might respond as they do. Leaders embrace the opportunities to know those around them, because it gives them a new chance to learn.

A leader knows that learning is the never-ending evolution of self-discovery. In the big events and the little occurrences, the leader takes time to develop a mastery of those items believed to be critical to success [Bennis and Nanus, 176 and 190-194]. Andrew Carnegie, the noted industrialist and philanthropist, was a focused leader. He was able to seize opportunities, lead others, and succeed because he was an insatiable learner throughout his life; and, he believed that the true road to pre-eminent success in any endeavor was to make yourself a master in that endeavor—to be inquisitive, to study, and to master the intricacies of whatever you set yourself to do. Carnegie's leadership in business allowed him to indulge his passion for

learning as he endowed libraries throughout the United States to increase the wealth of learning for Americans [Tedlow, 19-71].

Another noted industrialist leader who believed in the necessity of thinking and learning to lead was Thomas Edison. Leaders must learn daily from every effort, even those efforts that do not themselves offer success in the end. As Edison observed after thousands of failures to bring the electric light to fruition, “I have not failed. I have just discovered 10,000 ways that don’t work [Edison as quoted in Kimble and Wertheimer, 88]!” Leaders recognize setbacks as learning experiences that prepare them to be better able to take advantage of the next opportunity, of the next challenge, of the next confrontation.

True leaders are open to new learning as it helps to form a repertoire of experiences that can be called upon to develop more nuanced responses to unexpected and challenging events. Successful organizations recognize that to develop seasoned leaders, the inexperienced leader needs to be exposed to a broad spectrum of experiences. The military is a great believer in learning as a way to develop junior leaders. It rotates its officers every two-to-three years among positions as a means of exposing them to different and challenging assignments. General Electric and IBM, firms renowned for their leadership development programs, also rotate promising leaders through multiple positions to develop their understanding of all facets of the organization. Such rotations give leaders a broader perspective as they move higher up the leadership ranks. An executive recalled an early learning experience in his career that was centered around learning the organization from all aspects:

As one of us recalled from his executive experience, his earliest and most beneficial leadership training experiences required him to work within each area of the company before beginning the job he was actually hired to perform. The lessons learned and the insights gained through this training experience provided him with a good understanding of how the company operated and the importance of each part in making the whole company successful. While some things can be learned from a book, there is no substitute for a leader learning about the organization from a hands-on, in the trenches perspective. He was so impressed with how well that training experience prepared him to do his job with that company; therefore, he was enthusiastic about making a similar experience a part of his leadership training when he became an executive and co-owner in a business on his own. In fact, he and his fellow executives used a similar training approach for all of their employees so that everyone had some understanding of what everyone else in the company did; such an approach is central to making any business a success

Leaders learn from their diverse experiences and help those who follow and serve to also engage in learning experiences. The executive went on to observe a serendipitous result of such learning is that it can also be good for the morale of the organization when everyone knows that their leaders have a hands-on knowledge and appreciation for the job each one does to make the team successful. One of us who owned an environmental testing firm at one time stated that everyone hired, from the high school student working in the summer to the Ph.D. in biology, begin by learning how to wash dishes and clean the labs properly.

Learning as a leader is not just about mastering the intricacies of the task at hand. Leaders also recognize the necessity of transmitting the passion for learning into the individuals who follow. As one of our MBA leadership course speakers, a now-retired leader of a German-based firm led organizations around the world. He was known as “Mr. Fix It” in his company and was sent to countries such as China and Japan to fix operations at underperforming subsidiaries. Although slightly dyslexic and not all that good with accounting, he overcame his handicaps by studying and learning. In fact he reads a great deal. Asked about

his favorite book by one of the students, he cited Machiavelli's *The Prince*, Sun Tzu's *The Art of War*, and David McCullough's *Truman*.

"Mr. Fix It" also likes biographies; as he impressed upon the students, "You should read about leaders such as Truman and ask yourself why they made decisions as they did." Leaders inspire others to lead by developing in them a passion to think and learn. This passion must be demonstrated in both word and deed. "Mr. Fix It" rose to high leadership positions because he took the time to learn, and as he reflected on his success, he took time to teach those following him that the pursuit of learning was the foundation of learning to lead.

Finally, no discussion of leaders learning their leadership skills can be complete without addressing learning from what has been tagged as the "Toxic Leader." Robert Sutton, a management professor, has observed that although some people behave badly wherever they go, everyone is capable of turning into a demeaning individual under the wrong conditions. These wrong conditions are what leaders must learn to recognize. For the jejune leader, some of the strongest leadership lessons learned are those that more senior people truly wish they had not imparted. The young leader-in-training observing the Toxic Leader in action is faced with a choice—either replicate the boorish, humiliating behaviors of the senior or resolve that when in a position to exercise leadership, realize that everyone deserves our respect; thus, the Toxic Leader's negative lessons will not survive into the next generation [Sutton]

Winston Churchill, commenting on the ultimate leadership challenge of leading individuals into battle observed that, "When you have to kill a man, it costs nothing to be polite [Churchill, 543]." Good leaders learn to demonstrate respect to others in all their professional dealings; in contrast, more toxic leaders may argue that they are berating or belittling only those who are incompetent. Yet the leaders that most individuals strive to emulate are those who have learned the value of all, who show respect to everyone, and are still capable of requiring and assessing the highest professional standards.



## LOVE.

Look. Listen. Learn. Love. The fourth precursor to leadership is perhaps the most important. We use the term “love” continuously, but lightly, all the time. Name five songs that you like. How many of them contain the word “love” in the title or lyrics? How many times have you said that you “love” a particular food, or “love” your car, or “love” an activity that is part of your everyday life?

When we hear the term “love”, we often think of romantic love, but love, passion, kindness, and concern for others are important to the successful leader in both personal and professional relationships [Darling and Walker, 353]. The best leaders have a sincere affection for their followers and passion for their organizations [Goleman, et.al. 223; Bolman and Deal, 329]. While we all have heard of people who fought their way to the top by trampling on everyone around them, the great leader needs to be passionate about the situation and the people in it [Welch, A14]. It is important that what the leader is doing matters; that it makes a difference. Likewise, the true leader needs to give and receive respect, trust, empathy, kindness, and consideration. In doing so, the leader brings out the best in the subordinate, the situation, and him or herself.

Recently, a Cub Scout leader, discussed the need for a leader to exhibit love to maintain his own performance level and to influence his subordinates. “To be a Scout leader, I not only have to love what the program stands for, but I also have to love doing it. Not everyone is excited about walking five to ten miles in rough country with a 40-pound pack. If I had complained, the boys would have as well.”

A now-retired international businessman speaking in our MBA leadership course expressed the importance of that same mutual love and its outcome; he found many employees who wanted to work for him, because he protected them and ensured that they prospered in their professional positions. He made certain bonuses were always paid and pay increases were enacted as scheduled, and he supported them when they were criticized by others. In return, his employees gave him and the organization loyalty – they worked hard, set high goals and lived up to them. “Everybody became a leader,” and employees went home to their families knowing their jobs were “safe.”

Sometimes this feeling of love is established by policy and expressed succinctly to newcomers to the situation by those already in a leadership role. Perhaps the reason for the West Point graduates as Army officers is partially explained by the West Point Department of Social Sciences’ policy of making it clear to new faculty upon arrival that there were two rules: first, “Be kind!” and second, “Keep us informed.” To the Department, which produced leaders such as Wes Clark and David Petraeus, “Be kind!” meant to love and care for all those in the Department and its students.

Love leadership may take the role of leading others to an appreciation of the efforts and worth of co-workers in the organization [DeLong, et.al, 6 and DePree, Leadership Is An Art, 95]. One of us tells of his wife joining a quilting guild comprised of quilters of many ages and skill levels. The Program Director, during a holiday party, demonstrated that leadership builds love and appreciation among all members. This particular Christmas meeting was for exchanging quilt blocks. There were many different kinds of blocks, from very simple to elaborate, but there was one particular set that was, by most standards, not well sewn. Among members of the group there was quiet talk that no one wanted to “get stuck” with those ill-done blocks. While the majority of the blocks were machine sewn, these whispered-about blocks were hand-sewn. The quilter who had hand-sewn her blocks was 82-years old, and, although her sewing skills had

deteriorated over the years, her love of the Christmas block exchange never wavered. Each year she worked diligently on her blocks so she could participate and share in the fellowship.

The whispering soon caught the ear of the Program Director. Wanting to ensure that all members felt as if their participation was important and valued, the Program Director began the block exchange by promoting the virtues of the ill-done blocks by extolling the virtue of the blocks being hand-sewn when most today are machine made. Additionally, these special blocks were made by the guild's own "Miss Ruby."

The Director asked Miss Ruby to come up to sign and date each block. The tone of the group changed; most of the other women of the guild now wanted one of "Miss Ruby's" blocks as a memento of this Christmas. The blocks became even more cherished within the guild when, two years later, Miss Ruby passed away. This Program Director was a loving leader, finding worth in someone's effort and guiding the group to embrace the efforts of all. From the one with the greatest skills and talents down to the one whose skills had diminished with time, the loving leader holds all genuine efforts as valuable. By building love for one another within the group, the loving leader builds a group more able to face adversity and trust the capabilities and talents of each member.

But love in the role of leader does not mean a "free pass." In auditing organizations, much importance is placed on the importance of "the tone at the top." Recognizing the tremendous impact of the leader on all aspects of the organization, auditors actually assign more risk (and more audit effort) to organizations whose leaders seem lacking in integrity. Loving leadership is tough love; neither the leader nor the subordinates are allowed to "get by." Even good people make mistakes, and the leader has to balance present actions against the future consequences of their behavior. Leaders who love look for ways to preserve the good and use both the good and the bad to teach. The loving leader can often use difficult situations to mentor and teach good leadership skills.

Consider the case of a seasoned naval officer and a young sailor that one of us observed. The Executive Officer (XO) of US Navy warships have a responsibility to the Commanding Officer and everyone else serving on the ship for good order and discipline. Discipline problems on a ship are rare while at sea but occasionally happen when the ship pulls into a liberty port after a few weeks away from land. Any discipline problem that arises must be addressed at XO's Mast to determine whether the offense warrants being sent to the Commanding Officer for action. Being forwarded to the Commanding Officer from the XO's Mast is a disaster for the career sailor, typically stalling any further advancement for a two-to-three year period.

During one tour, one of us observed a rising-star young sailor who appeared to be on the fast track for promotion to Chief Petty Officer went on liberty and got involved in a scuffle on the street with a fellow sailor over an inconsequential matter. Unfortunately, it attracted attention, and Shore Patrol brought the two back to the ship. Being returned to the ship by Shore Patrol for a public disturbance automatically resulted in the rising star being arraigned for XO's Mast. Suddenly, instead of looking forward to promotion and increased responsibility, the young sailor now faced demotion and loss of his current leadership position. The ship's executive officer (XO), knowing that the behavior was out of character but that the incident was so grave that it could not be ignored, was in a difficult position. The offending young sailor needed to understand the gravity of the situation and other members of the crew needed to see that even the best and highest among them must accept the consequences of unacceptable behavior.

Instead of the traditional XO's Mast, however, the XO decided to bring in the sailor's entire division. The embarrassed young sailor stood at attention as his immediate superiors, his peers, and his subordinates, one by one, stood up for him and declared what a responsible and fair leader he was. The XO had the sailor look at those who had stood up for him and asked how he, as a leader --the person to whom everyone else would turn for advice, counseling, and guidance -- would have handled one of his men who had acted as he had. He was ashamed and said he would have a hard time standing up for the man. Through this experience, the XO tried to pass on a lesson. The young sailor had put his future in doubt, and a loving leader had given him that future back by teaching him a lesson without sending him to the Commanding Officer for final discipline. Four months later, the sailor, recently promoted to Chief Petty Officer, brought his wife and family to meet the XO and explained that this was the individual on the ship who still had faith in him even when he had lost it in himself.

Tina Turner asked in her Grammy-winning song of the same title, "What's love got to do with it?" For the best leaders -- for the leader sincerely interested in the welfare and future of his superiors, his peers, his subordinates, as well as the organization -- the answer is, "A lot."

As you look at the love you currently exhibit as a leader and at developing more love in your role as a leader, ask yourself questions such as:

- What leaders have I seen who really love?
- Negative examples are useful too: what leaders have I seen who do not love?
- Who or what do leaders love?
- How do leaders show their love?
- When was the last time I said "thank you" to someone?
- What is the ratio of praise to criticism in my comments to those around me?
- What more can I do to develop or exhibit "love" in my leadership role?

## LAUGH.

The final precursor for leadership is to laugh. Laughing is much misunderstood as a primary way to connect with others, establish resonance, and lead them. As Daniel Goleman and his colleagues note, humans are deeply emotional and have an open-loop limbic system. That is, emotion is contagious, because we are wired to connect with others. Perhaps the most contagious emotion is laughter, and it is often manifested as glee or smiles. To them and to us, “the artful use of humor typifies effective leadership [Goleman, et.al. 10 and 34].”

Laughter is a great antidote for weariness and even depression. Even the most difficult task can be lightened by mirth [DePree, *Leadership Jazz*, 222]. As Herbert Gardner has observed, “Once you get people laughing, they are listening and you can tell them almost anything [Gardner as quoted in Jonas, 65].” Laughter has been shown to prolong life and increase health and a feeling of well being. Encouraging employees to find laughter and share it leads to more productive, emotionally supportive organizations. And laughter makes it fun [Katz, 22].

One of us recalls from his career in the Navy that he and his small team were responsible for ensuring that his Admiral had all the proper briefing materials for each of his trips. And that task was but a small part of an even larger portfolio that included accounting for hundreds of millions of dollars and ensuring the hiring processes for any new hires were properly followed. Often times the team was subjected to short-notice drills that induced stress, rearranged work flow, and interfered with personal plans. Yet, the staff never missed a deadline.

As he found, laughter delivered them in times of stress. Laughter was most often shared at monthly lunches, a routine that was never altered regardless of the work load. And there was always something to celebrate whether it was someone’s birthday or another special event. These lunches were full of laughter as staff members shared the ridiculous, the trivial, and the not-so-trivial incidents that happen in every office. This opportunity to laugh built the team and sustained it through its demanding schedule.

When new short-notice drills arrived in the office, this officer was able to lead his team such that no one ever shunned working on the briefing books. Rather, staff questions became, “What can I do to help?” As he found from these and other experiences, laughter is necessary to sustain others. It defuses tension, it bonds people into teams, and it allows teams to achieve the near impossible. When is laughter important? All leaders have to develop their own sense for when laughter is the best medicine, and all leaders understand that it is one medicine that can be used for almost any illness.

As the COO of a successful company, one of us never saw himself as someone most people would consider funny; rather his is a dry wit often containing bad puns and word play that generally makes people moan and groan and roll their eyes. Even so, he found that his attempts at humor were successful in at least opening the door to smiles. By signaling that the boss is open to laughter, he was able to increase his effectiveness as a leader.

He learned that the best laughter did not come at the expense of someone else, at least not without that person’s consent. Self-deprecating humor, appropriate jokes, and funny shared experiences are examples of the types of humor that allow all to laugh with each other without harming anyone. He found that planning opportunities for his leadership team to get together periodically in relaxing situations that were conducive

to sharing and laughing together were highly effective. In fact, team members were much better than he was at suggesting the types of gatherings that would make them feel relaxed and comfortable.

After a successful career as a leader, he concluded that good leaders did not go too far in either direction; that is, they were not all seriousness or all levity, but rather they wove a tapestry that balanced the two. Thus, with the right balance, relaxing and laughing together can be priceless in leadership by helping to re-energize the team while contributing to the development of team spirit and camaraderie that carries over into work.

Several of us are involved in Business School leadership and in such volunteer organizations as the Boy Scouts and Rotary Clubs; we too have learned that laughter helps. In leading faculty, we found at times the climate in one of our academic units was negative. It seemed like people were afraid to laugh, and it showed in everyone's performance. A new leader came in, and changed the climate to one where people ate together, laughed together, and worked together much more effectively. As we learned, this new climate ensured that old and new faculty in the School were more relaxed and enjoyed working together. As a consequence, we were able to achieve successes many thought impossible, primarily because of the faculty's ability to work together and support each other.

With his Boy Scouts, one of us found that during campouts, memories of other more challenging outings were often the topic of conversation. While the Scouts did not laugh during challenging times, laughing about them later helped to celebrate the fact they were able to overcome difficulties. They also laughed at each other, and at him. As a consequence, he used these humorous times to build a successful relationship with them and added to their learning, which is the essence of what scouting is all about.

As a Rotary leader, one of us worked to get the Board and the whole 250-person Club to at least smile. Like the COO mentioned above, his humor mostly occasions eye-rolling reactions and is most often directed at himself. But the Club achieved a great deal during his tenure, and he was widely recognized by the Club after his one-year term.

### **LEAD.**

Pervasive and perennial transformations confront us in every realm, whether internally in our organizations or in a highly integrated global economy. We also experience dramatic changes in technology, in our governing structures, and in our families and social lives. Recent crises add to the stew. With so much change facing us today, leadership is needed at all levels.

We posit that the only way out of this turbulence is through others who are willing to do "leader-work." As Faye Wattleton reminds us, "The only safe ship in a storm is leadership [Wattleton]." Simply stated, "leader-work" or leadership is developing a vision, mobilizing others, taking responsibility, and making changes that benefit others.

Developing a vision is not as complicated as it is cracked up to be. For the most part, the process is not some drawn-out, agonizing review of all options before selecting a solution. Most often, a vision is a gut feeling that something can be done better or that some problem can be solved [Bennis and Nanus, 82-98 and 131-132]. It derives most often from looking and listening to others and in learning from them. Thereafter, as Diane Feinstein observes, "Ninety percent of leadership is the ability to communicate something people want (or need) [Feinstein]."

With a vision in hand, leaders mobilize others to agree that such an improvement or solution is worth trying [Kotter, 9-11 and 85-116]. And mobilizing others is done through love or passion for the issue as well as emotional resonance often gained through laughter. Virtually everyone is willing to test a pilot, whether in corporate or voluntary organizations especially if we are convinced that the new approach offers an improvement over the old way. The key is to make the case through discussions with others. From our experience, the best way to mobilize others is to state the problem, propose some ideas for solving it and turn to others for input. And that input is central to finding better solutions to the many challenges that plague and perplex all organizations, building support among the many stakeholders' institutions encounter, and ensuring that a sensible solution is implemented.

Undoubtedly the hardest part of leader-work is taking responsibility; that is, taking charge of the idea, problem or activity [Puryear, Lecture, April 7, 2009]. Too often people seek to avoid the criticism or "hassle" that comes with being in charge. And criticism is synonymous with leader-work, for critics abound. Ralph Waldo Emerson once remarked, "Whatever course you decide upon, there is always someone to tell you that you are wrong [Emerson]."

And taking responsibility almost always means making changes - changes that bring forth still another round of criticism. Many times we are all too cautious, too hesitant to alter the tight worlds we live in. Yet the changes we so often fear are often primary sources of creativity. We must intuitively recognize that without change to improve our lives and circumstances, the turmoil around us will only multiply.

Accepting that visioning, mobilizing, seeking responsibility and changing are leader-work, which leaders are to do the work? Who are these people so needed to improve our lives? To borrow from Pogo, "We have met the leaders, and they are us!"

Leaders work everywhere. Too often leadership is assumed to be only at the top of organizations. That is, leaders are seen as presidents, chief executive officers, executive directors or chairmen. Some might concede that mid-level leaders hold the keys and turn to vice presidents, directors, provosts or deans. And organizational leadership is strenuous:

Difficulties accumulate such that organizational leadership is like movement at night in an unfamiliar and fast-flowing river. In such circumstances, every motion is surprisingly slow and subject to careful calculation. The resistance encountered is beyond the ken of most observers, who masquerade as knowledgeable critics but essentially are weak swimmers. [Walker, "Elmer Staats," 282]

But leader-work is most often done elsewhere, by everyday and low-level leaders who make changes that better our daily lives. In fact we need every day and low-level leaders more than those at higher organizational levels. Every organization needs leaders just as it needs followers, but at times followers must step up and be leaders as well.

We are convinced that leading is preceded by looking, listening, learning, loving and laughing. In fact, leaders we see the whole process as an equation: Leadership = L<sup>5</sup>. Without these five precursors, no leader can succeed fully. Thus leaders recognize that once these precursors are in place, they can proceed to develop a vision, mobilize others, take responsibility, and make changes that benefit all others -- our definition of leadership. Such changes in the end are the only sure antidote to the crazy, frenzied world that seems to envelop and discourage us. Leaders who make positive changes give us hope, hope that we all

desperately need to meet the day and move our world to a place where leaders and their organizations care more deeply for all their stakeholders.

Again with apologies to Yogi Berra for borrowing his diction:

It's amazing what you will hear, if you just **listen**.

It's astonishing what you can see, if you just **look**.

It's revealing what can happen, if you just **learn**.

It's delightful what you can accomplish, if you just **love**.

It's remarkable what support you will get, if you just **laugh**.

It's world-shaking what you can do, if you just **lead**.

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# **MONETARY POLICY OF BOSNIA AND HERZEGOVINA AND ITS FUNCTION DURING THE CURRENT ECONOMIC AND FINANCIAL CRISIS**

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## **ABSTRACT**

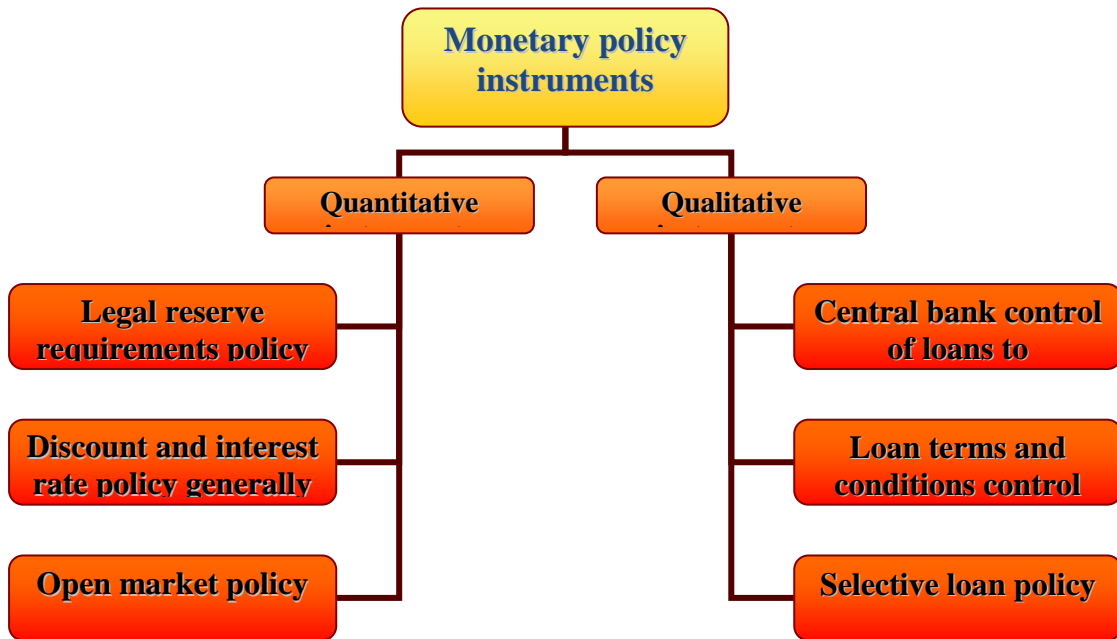
*Monetary policy makes the integral part of macroeconomic policy by which a country implements its economic policies. Traditionally, the monetary policy consists of issuing and controlling the quantity of money in circulation, participating in open market operations, and setting the interest and discount rates. The role of the monetary system and the monetary policy in general is somewhat different in Bosnia and Herzegovina as supposed in other open market economies. Bosnia and Herzegovina applies the fixed exchange rate of the national currency based on the principles of the Currency Board which is established on the Euro pegged national currency – convertible mark (KM). In spite of the advantages, the Currency Board has also showed certain disadvantages which were particularly indicative at the time of the global financial crisis. The current research discusses the role of the Central Bank of Bosnia and Herzegovina, its monetary policy, and advantages and disadvantages of the Currency Board.*

## **1. MONETARY POLICY: GENERAL CHARACTERISTICS**

Traditionally, the macroeconomic policy is coordinated with the fiscal policy, monetary policy, and the foreign exchange policy to suit the needs of all economic participants. One of the most important segments of any macroeconomic policy is its monetary policy. Usually, the monetary policy aims to achieve economic stability, currency circulation, stabilization of prices, and the exchange rate stability of one nation. Consistent and timely monetary activities of monetary authorities are of a great importance for the overall

economy and its financial system. While selecting the macroeconomic policy instruments, the attention should be paid to the openness of the economic system (i.e. to the level of international commodity and service exchange), international capital mobility, and the currency exchange.

Figure 1 gives an overview of the monetary policy instruments traditionally used to achieve goals such as controlling the money supply and, therefore, currency circulation; monetary, fiscal, and macroeconomic stability.



**Figure 1. Monetary Policy Instruments**

Selecting the model to manage the monetary policy is particularly important for the liquidity, safety, and efficiency of an economic and monetary system. This particularly holds if the part of that system is a double-layered bank system with the Central Bank as its pillar. Depending on the objectives of the economic policy, the monetary policy and its measures can take different forms. For example, if the goal is an increase in productivity, a stimulating monetary policy and measures need to be implemented. On the other hand, if the objective is to control the level of prices, then a restrictive monetary policy should be in place.

## 2. CENTRAL BANK AND MONETARY POLICY OF BOSNIA AND HERZEGOVINA

In majority of countries, a central bank creates and implements the monetary policy. The Central Bank of Bosnia and Herzegovina (CBB&H) is established on the same principal. However, there is one important difference between the CBB&H and a *traditional central bank* operating in an open market economy. The CBB&H operates on the *Principle of Active Participation of the Currency Board*. This is a common principle that has proven to be very efficient in structuring the monetary policies of the economies in transition and the post-war countries.

Monetary policy of Bosnia and Herzegovina is based on the following principles:

- Coverage of monetary liabilities of the Central Bank with the net foreign currency reserves in the amount of 100%;
- Unlimited convertibility of KM into EURO at the foreign currency exchange rate of 1KM=0.51 EURO;
- Money supply includes: net foreign capital assets, loans, gross foreign currency reserves and sales and purchase of KM, and
- No participation in *open market operations*.

Another important characteristic of the CBB&H is a high level of institutional and financial independence. This implies that the Management Board of CBB&H defines, adopts, and controls the monetary policy of the entire country, B&H.

The law of Bosnia and Herzegovina (B&H) stipulates the basic principles of monetary policy and the policy of foreign currency exchange rate and the role of the CBB&H. This implies that the emission and withdrawal of the currency in circulation is performed by simple exchange of foreign currency and the local currency, and on the basis of the fixed and defined rate and CBB&H.

Monetary policy with such a concept ensures the real independence of CBB&H. This concept definitely disables the politicians and other interested parties to influence the actions of CBB&H without previously amending the legislation. This is one of the advantages of the Currency Board system in B&H. If this was not the case, there would be three currencies in B&H and each ethnic group (there are three ethnic groups in B&H – Bosnians, Croats, and Serbs) would print their own quantities as they please.

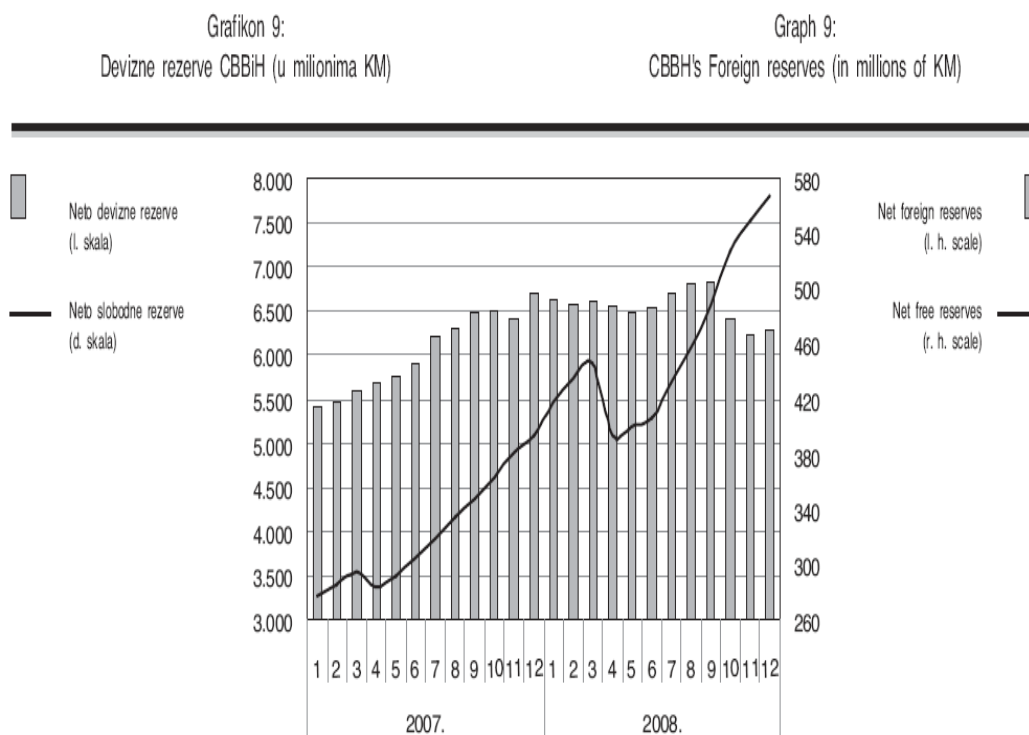
Another important characteristic of the CBB&H is its ability to realize significant income through its activities is of great importance. The Law on CBB&H stipulates that the profit should be distributed according to 60%-40% principle where the 60% is reserved for the budget of the state institutions and 40% for the increase of the capital of CBB&H. This unique approach furthermore strengthened the independent position of CBB&H.

The financial independence of the CBB&H has proved to be very efficient principle. Just within the first two years of this legislation implementation, the CBB&H transferred 38 million KM to the state authorities. Similarly the CBB&H has an authority to appointment the management bodies and the officials of the Central Bank. Namely, the Presidency of B&H appoints the members of the Management Board, and they, among their members, elect the governor for the term of six years (in accordance with the requirements of European Union). The members of the Management Board may be replaced only provided that they fail to observe the principles of monetary policy as prescribed by the Law or if they do not behave in compliance with the law.

Another interesting characteristics of the CBB&H is its credibilitiy or the way it is perceived. Since its establishment, the CBB&H has been seen as a highly credible body and it has achieved remarkable results. Namely, when in August 1997 CBB&H was founded and when the convertible mark (KM) was introduced as the local currency, three more currencies were in use in B&H. These three curenies were German Mark (DEM), Croatian Kuna, and Yugoslav Dinar. This was just one of the (numerous) negative sideeffects of the war that was experienced in Bosnia and Herzegovina. The country's economy was devided into two entities, while the entire economic system was destroyed. There was no economic connections between two entities. Within a relatively short period of time – between the August 1997 and until the end of 1999 – CBB&H managed to reintegrate the monetary system. The three other currencies that were used along with KM (DEM, Croatian Kuna, Yugoslav Dinar) were eliminated from circulation and the local currency, KM, became the only legal means of payment. Another great success in buiding up the confidence was achieved in the field of price stability. Namely, the price index shows that the inflation dripped from 13.3% in 1998 to 3.7% in 2005, and within the period 2002-2004 the average price increase was about 0.5%. In this way CBB&H managed to completely preserve the inner stability of the local currency.

The external stability was provided by successful maintenance of the fixed exchange rate and regular servicing of the external debts of B&H which is done by CBB&H as the fiscal and monetary agent. Throughout the years, the CBB&H has become the trustworthy institution and is considered to be out of

the reach of political influence. Namely, with its activity CBB&H, not even once, strayed away from its goals and thus made sure that the expectations of the public are completely met. As the CBB&H must have coverage in EUROS, Figure 2 presents the currency reserves balance in 2007 and 2008.



**Figure 2 Currency reserves CBB&H (mill. KM)**  
 Source: Central Bank B&H (CBB&H), Bulletin No. 4, 2008.

### 3. ADVANTAGES AND DISADVANTAGES OF THE CURRENCY BOARD AND ITS ROLE IN THE MONETARY POLICY OF BOSNIA AND HERZEGOVINA

Since establishing of the Currency Board until present time, there has been a debate about the adequacy of having the Board. One of the basic reasons for introducing the Currency Board in the countries considered to be the “*economies in transition*” is, certainly, the great sensitivity of the Central Banks to political pressures. The political pressure usually focuses on the budget deficit financing and the actions of the Central Bank, which, in return, frequently caused high rate of inflation and instability of the overall economic system.

The greatest disadvantage of this model is completely conscious waving of the series of instruments of monetary policy by the monetary authorities. The experience of some of the *economies in transition*, that have applied this model, shows the several advantages and disadvantages of the Currency Board model.

The advantages of the Currency Board model are:

- ✚ *guaranteeing convertibility of the local currency;*
- ✚ *guaranteeing price and monetary stability;*
- ✚ *introducing macroeconomic stability;*
- ✚ *improving foreign trade;*
- ✚ *stimulating the direct and portfolio foreign investments;*
- ✚ *stimulating the development of sound banking system and presence of foreign banks in domestic economy.*

This model is particularly advantageous solution for two groups of economies:

1. small and open economies with the emphasized orientation on international trade (large participation of the sector of „tradable goods“) and
2. the economies that did not have highly emphasized macroeconomic instability.

The success of the Currency Board model depends on other elements of economic policy as well. These elements include:

1. the level of the starting reserves,
2. firmness of fiscal policy and flexibility of its instruments,
3. flexibility of the labor market,
4. interest rates trend.

However, in spite of frequently mentioned advantages, this model is not the „remedy“ for all economic problems. Its disadvantages are:

- ✚ *Limitations, even prohibition of granting the loans as the last resort, which may lead to instability of the banking system;*
- ✚ *disabling the active monetary policy;*
- ✚ *limited protection from the impacts of speculations.*

The criticisms addressed to the system of the Currency Board are mainly related to the key principle of its functioning and that is automatism. By tying the hands of the monetary authorities, as regards to their discretion to monetary policy, the system indeed serves as the stabilizer of the foreign currency exchange rate and prices. Adjusting the economy of Bosnia and Herzegovina to absorb the external economic shocks is carried out by adjusting its activities and adjusting the money supply, level of domestic prices, salaries and



employment. Therefore the currency board is frequently criticized as the mode of monetary policy not being able to stimulate the development of B&H economy.

Historically, the comparative statistical methods and formal econometric analyses have shown that the Currency Board is able to provide better results compared to other regimes of the fixed foreign currency exchange rate. For instance, it turned out that the existence of the currency board reduces annual inflation by 3.5% as a result of the „trust effect“ which basically occurs due to faster increase in money demand.

Another criticism of the Currency Board model focuses on its reserve requirements. The critics argue that keeping the reserves is inefficient and that disables usage of the available resources that would otherwise be at the disposal of the system of discretionary monetary policy (partial reserves). Namely, the critics of the Currency Board notice that there are reserves of the local currency which never get convert into the reserve currency. This is particularly important given the fact that when applying the model of the Currency Board, especially in the case of the economies in transition, the decisions are practically made between the channels that stabilize the economy and the ones that transfer the authority of monetary policy.

The Currency Board in Bosnia and Herzegovina requires that anyone who wants to have local currency – the Convertible Mark (KM) – must buy it with another foreign currency. In the case of buying KM by the reserve currency – in this case by EURO—the purchases are made on the basis of the *fixed foreign currency exchange rate*. However, if the local currency is purchased with some other convertible currency, then the transaction is based on the *market exchange rate*. From the perspective of CBB&H balance that means that its monetary liabilities may never be greater that the foreign currency active assets. The liabilities of CBB&H consist of the cash KM emitted into circulation and the credit balance of the residents, deposits of the commercial banks, deposits of other local sectors, except central government. Foreign currency active assets consist of foreign convertible currency cash in the safe deposits of CBB&H and assets at foreign banks either as deposits or investments in stocks as well as net foreign reserves.

#### **4. MONETARY POLICY OF BOSNIA AND HERZEGOVINA UNDER THE CIRCUMSTANCES OF FINANCIAL CRISIS**

Due to the conservatism of the Currency Board system, CBB&H has tied hands during the current global economic and financial crisis. Its only monetary

policy instrument has been the required reserves rate. Therefore, the fiscal policy become the priority given the fact that its full efficiency is seen in stabilization of the state budget (reduction of the deficit) and in management of the national debt.

As previously stated, one of the main advantages of the Currency Board is the stability of prices (anti-inflation effect) which certainly is the advantageous solution under the current global crisis. Due to the fixed currency exchange rate, local banks, mainly in foreign ownership, are thus protected against currency risks which can arise under the circumstances of the global financial crisis. This is yet another advantage of the Currency Board system of Bosnia and Herzegovina. For all the above stated characteristics, the banking sector is well protected from the influence of the crisis.

The other side of the picture, the dark one, shows all disadvantages of applying the fixed foreign exchange rate and, along with it, the disadvantages of the Currency Board in Bosnia and Herzegovina. This refers to the real sector of economy where, above all, there is negative foreign trade balance of the current account of the state (i.e. very high foreign trade deficit). This problem did not arise with the crisis and it is a common problem facing the economies in transition. Unfortunately, Bosnia and Herzegovina failed to make and thus implement the macroeconomic stabilizing strategy at the state level. The fundamental postulates and principles of that strategy should have been related to the local economy and establishing competitiveness with the economies of the neighboring countries, Europe, and the World. With strengthening of the local industry, especially production in the local companies where new values are created, Bosnia and Herzegovina, with its macroeconomic strategy of development, should have emphasize its comparative advantages. This would be a solid foundation for its future economic development.

The monetary system of Bosnia and Herzegovina made the great contribution to the country's economic stability despite the global financial crisis. In this case, Bosnia and Herzegovina applied the principles of the German (and later on European Union) monetary system. Knowing the fact that the essence of the EU economic policy is stability of prices (anti-inflation), it is clear how much importance is given to the currency. The essential difference between the economic objectives of EU and USA is that EU emphasizes stability of prices while the USA emphasizes the economic development. The evidence for this is a recent reaction of the USA government related to the fight against the financial crisis, which consisted of adding the additional quantity of dollars (around 750 billion) into the monetary system in order to strengthen the economy. This would not be the positions and policy of EU. Unrealistic

foreign exchange rate, which is the result of the over-valued of the local currency, additionally stimulates import and discourages the export.

## **5. MONETARY POLICY OF BOSNIA AND HERZEGOVINA IN THE FUNCTION OF ECONOMY STABILISATION UNDER THE CIRCUMSTANCES OF FINANCIAL CRISIS**

The commercial banks of Bosnia and Herzegovina used the current financial crisis as an excuse for unjustified increase of the active interest rates. The only thing that CBB&H could do in this case, as one of the measures of monetary policy, was to reduce the rate of obligatory reserves of the commercial banks in order to provide the banks with additional disposable assets. In combination with the rate of capital adequacy and with the reduction of rates, CBB&H tried to lessen the consequences of the financial crisis.

Unfortunately, there is no universal model of “how to lead the policy during the global financial crisis”. Each country, according to the level of the economic development, political and social environment, and general strivings, selects the most adequate model of its own. Practical application has proved that what is good for one country may not automatically be applicable in others. Nevertheless, the fundamental postulates of the selected models in the countries are very similar.

The basic characteristics of the model of the Currency Board in some economies in transition such as Bulgaria, Estonia, and Lithuania, show similarities with Bosnia and Herzegovina. These three countries are the ones that have already become the members of EU. At the moment, the three countries are modifying their monetary system according to the requirements of the European Monetary Union (EMU).

The model of Currency Board is generally acceptable and it is applicable in different political and economic environments. It is true that this model has not given the same results in each country, but, still, the main characteristics of the model, in the first place stabilizing effect, can be recognized in the examples of some of the best known Currency Boards in practice. In the short-run, the system of Currency Board has a stabilizing effect, while in the long-run, it only represents transition to the full “European-like” monetary system of a country.

In the case of Bosnia and Herzegovina, the system of Currency Board is acceptable. However, it is necessary to reform it in two directions: devaluation of the currency and more efficient use of the foreign currency reserves of CBB&H. The former direction refers to the necessity of correction of the

exchange rate KM-EURO as, under the circumstances of the present financial crisis the exchange rate completely dis-stimulates the local economy which is oriented towards export and even more it stimulates import. With the correction of the exchange rate the local businessmen would come to the equal position compared to the importers who are, with the presence of their own lobby, additionally stimulated by the too strong exchange rate. With the more efficient use of the foreign currency reserves of CBB&H, which serve as the coverage for the convertible mark, B&H would come to the situation to emit its own stocks (in the first place the short-term and long-term bonds) which would further imply positive effects to several directions:

1. with the emission of the stocks (bonds) the state would be able to settle the debts for former foreign currency savings and pay for the war reparation and invest into the capital projects;
2. the capital market would be revived by additional materials as the state treasury stocks would become the part of the trade;
3. among other things, it would be the foundation for the reforms of the retirement plan and creation of the pension funds that would mostly invest into the state stocks;
4. all above stated would create competitiveness to the banking sector which, due to market mechanism and not the state pressure, would be forced to reduce interest rates through the money offers but not from the banking sector but from the developed financial market.

## **6. CONCLUDING REMARKS**

The goal of any economy in transition is to achieve macroeconomic stability and to have a stable local currency. With enormous war destructions, post-war traumas, ethnic divisions, and mutual distrust within the country, the existing monetary policy and the existence of the CBB&H are proving to be beneficial. However, in order to establish mutual trust and develop overall stability of B&H society, it would be very risky to give a mandate to the CBB&H to lead the discretionary monetary policy.

Under the unfortunate conditions of economic and social destruction, as well as great needs for financing, rebuilding, and reconstruction of the country, the discretionary monetary policy would expose CBB&H to insurmountable difficulties in defining such a monetary policy as well as its implementation.

Great pressures for financing such increased needs by means of (uncovered) emission of money would certainly result in the high inflation and overall macroeconomic instability. This would make the conditions for prospective

investors even more difficult for investments into economic and social recovery of B&H.

Considering everything we mentioned so far, the model of Currency Board was the most appropriate solution for B&H. Bosnia and Herzegovina has several tasks to achieve:

1. integration of the economic area in one monetary sphere;
2. building the single economic system;
3. achieving the macroeconomic stability by means of stable currency;
4. avoiding all possible conflicts of political, ethnic, entity, or partisan nature;
5. avoiding possible influence of the executive authorities on the monetary ones;
6. consideration of the regional and economic growth and development factors.

In order to recognize the characteristics of the Currency Board in practice (i.e. in leading the monetary policy of CBB&H), it is necessary to analyse all the aspects of business activities of CBB&H and the instruments at its disposal. Under the normal conditions, the system of the Currency Board mostly serves as the instrument of anti-inflation and stabilization. On the other hand, due to the overvalued local currency, especially under the circumstances of the financial crisis, it additionally deteriorates the position of the local companies, mainly the exporters.

The non-use of the reserves of CBB&H additionally facilitates the monopolistic behaviour of the banking sector which, under the circumstances of not having any competition, arbitrarily dictated the amounts of active and passive interest rates to legal and physical entities.

The generally known fact is that the best and most famous B&H brand in the world, i.e. the refugees, were the ones whose remittances enabled creation of the strong backing of the local currency. The CBB&H very easily provided the necessary funds to cover the local currency. Recently there has been an increasing trend of remittances from abroad, so that, sooner or later the foreign currency reserves of CBB&H will be questioned and they will simply „melt“ because of payments of the foreign debts and especially because of financing the import that takes the money out of the country.

The authorities of Bosnia and Herzegovina are facing a very complex task of acceleration of all necessary economic, monetary, and fiscal reforms. There is a need of bringing a uniformed macroeconomic strategy of B&H at the state level and giving the clear guidelines of action to economic agents. This

particularly refers to the monetary policy based on Currency Board which, under the „stable circumstances“, proved to be vulnerable, especially in the times of crisis. This clearly implies that there is no universal model of monetary policy that would prove to be efficient and applicable to majority of the countries. The undeniable right of each country is to select and implement the adequate monetary policy. Frequently, this is a very complex issue, especially for small, open market economies where the selection of the monetary policy model must take into consideration the existing economic, political, and social circumstances. The creators of monetary policy are obligated to adjust the monetary activities to the level financial system development. It is certainly the case that in combination with the stimulative fiscal policy, the adequate and carefully selected monetary policy is a significant factor in achieving the macroeconomic stability of any country.

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## **ANTECEDENTS OF CORPORATE SOCIAL RESPONSIBILITY IN CHINA: AN EXPLORATORY STUDY**

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### **ABSTRACT**

There have been few, if any, economic transitions as monumental as the growth of the private sector in China. Both privatization and venture creation have contributed to rapid and sustained growth. This rapid transition to capitalistic practices in a communist context has had unfortunate consequences. The checks and balances that safeguard stakeholders from harmful consequences of capitalist practices have not grown as rapidly as the private sector itself. As a result, corporate social performance of private Chinese enterprises has suffered. Anecdotal evidence includes examples such as: avoidable industrial accidents that have claimed the lives of many Chinese workers, the death of school children caused by the collapse of faultily-constructed school buildings, and the production and distribution of tainted baby formula and dog food. While government regulation offers one approach to addressing this problem, it has proven difficult for Chinese agencies to keep pace with the rapidly evolving private sector. A complementary solution consistent with communist ideals is self-regulation by Chinese businesses; that is, self-initiated corporate social responsibility (CSR). There has been much interest recently in Chinese CSR.

If CSR is to provide a viable counterweight to the pressures of a massive capitalist economy, it must be widely adopted and effectively implemented in China. By definition, CSR cannot be mandated by government but must be voluntarily employed by Chinese businesses. Adoption of CSR can be consistent with capitalist practices – at least in the long run. Waddock and Graves [4] found that corporate social performance in developed, capitalist countries is related to prior and to future financial performance. They speculated that prior financial performance creates slack resources that businesses may be able to use to improve their social performance. As such, investment in social performance may in turn lead to better financial performance. Waddock and Graves posited a virtuous cycle in which social performance and financial performance reinforce each other. But this virtuous cycle might not exist in developing economies because the financial consequences of poor social performance are likely to be muted. In a developing country such as China, there are weaker checks and balances on capitalist

practices in terms of less developed regulatory agencies, news media, unions, consumer rights groups, etc. As Haigh and Jones [1] note, CSR research tends to focus on win-win situations in which both the corporation and the stakeholders can become better off through CSR. Research has not dealt as extensively with zero-sum situations in which benefits to one stakeholder group come at a cost to another group. Such zero-sum situations may be more common in developing economies where checks and balances are still evolving. Therefore, understanding the adoption of CSR in China requires a broad perspective.

In focusing on the link between CSR and financial performance, most of the previous empirical CSR research has neglected other antecedent variables. However, several antecedents have been posited in theoretical work. For example, McWilliams and Siegel [3] hypothesized the following drivers of CSR: company size, level of diversification, research and development spending, advertising budget, government sales, consumer income, labor market conditions, and current stage in the industry life cycle. Haigh and Jones [1] listed six sets of factors associated with the promotion of CSR: intra-organizational factors, competitive dynamics, institutional investors, end-consumers, government regulators, and non-government organizations. Empirical research building on these theoretical propositions has been limited but there has been some research that examined the link between CEO characteristics and CSR. For example, Slater and Dixon-Fowler [4] examine the relationship between CEOs' international experiences and the CSR of their corporations. The dearth of additional empirical research on the antecedents of CSR is particularly problematic in the Chinese context where the link between CSR and financial performance is likely to be weaker.

Our current study is intended provide insight into the antecedents of CSR in China by examining a range of potential antecedents. We examine four categories of antecedents: founder characteristics, company characteristics, institutional influences, and market pressures. We administered a 12-page survey with 55 multi-part questions to the CEO or business founder of 4430 private enterprises in the People's Republic of China. The 4430 companies selected to be in our sample were located in eight major cities in the Pearl River and Yangtze River delta regions and represented 18 different industries. We obtained 902 useable survey responses for a response rate of 20%.

Preliminary survey results show which factors might affect the level of CSR in China but the cross-sectional nature of our data does not allow us to imply causality. The contribution of our exploratory research lies in our broad examination of potential antecedents of CSR in China. Detailed results of our findings and statistical analyses will be presented at the conference meeting. The variables included in our analyses are dependent variables of CSR priority as well as CSR itself (a 3-factor, 13-item scale). Our independent variables are divided into four types: founder-related, company characteristics, institutional influences, and market pressures.

Future research could extend our study by measuring promising antecedents at one point in time and measuring CSR at a later point in time. Because of the complexity of CSR in the Chinese context, there is perhaps a more pressing need for qualitative research examining the level and evolution of CSR in Chinese companies. Research paralleling Lamberti and Lettieri's [2] longitudinal study of an Italian food producer's adoption of CSR practices would be a good starting point for future research on CSR in Chinese firms. Another interesting research



direction would be a replication of Waddock and Graves [5] study using a dataset of Chinese corporations in order to confirm our supposition that the link between CSR and financial performance – the virtuous cycle – is weaker in China than in more highly developed countries.

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**Presentation to SEDSI, February 2010**

**“Teaching Leadership at The Citadel”**

**ABSTRACT:** Teaching leadership at The Citadel is an opportunity and yet a challenge, a challenge because The Citadel is passionate about developing principled leaders. This workshop seeks to review what is taught in leadership at the graduate and undergraduate level and to share the ideas of others on how best to teach such courses.

**AGENDA**

- I. **Courses I Teach and My Formative Experiences with Leadership.**
- II. **The MBA Leadership Course.**
- III. **The Undergraduate Leadership Course.**
- IV. **My Questions of You.**
- V. **Your Questions for Me.**

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**I. Courses I Teach and My Formative Experiences with Leadership.**

**A. Teach**

- 1. BADM 722, “Leadership In Organizations” and**
- 2. BADM 371 “Leadership In Organizations”**

**B. Formative leadership experiences: all of these have influenced how I have thought about teaching leadership at the graduate and undergraduate levels. Forgive the self-promotion, but I feel I have to give you my vantage points.**

- West Point Graduate.
- Command of armored units in Europe, Vietnam, and the U. S.
- Doctorate in political science and taught and wrote in this field for 18 years.
- White House Fellowship; also served as President of the White House Fellows Association
- Academic Administrator (Department and School) for 24 years.
- Executive with a Wal-Mart subsidiary; founder of the McLane Leadership School.
- Leadership of not-for profit organizations to include the White House Fellows Association, the Rotary Club of Charleston, Kansas City Economic Advisory Board.
- Graduate of every level of Army schooling through the National War College.

**C. Thus:**

- **I am heavily influenced by my background and experiences.**
- **My experiences are heavily skewed to political science, the military, and academic administration.**
- **All this has meant I have certain blinders about teaching leadership.**

**D. Your job today is twofold:**

- 1. To help me recognize my blinders and open up new avenues for me to think about teaching leadership.**
  - 2. To see how what I am doing you could use at your institution.**
- 3. I STRONGLY welcome your input and ideas as we go along.**
- 4. And we will provide time at the end of my presentation for your thoughts and ideas.**

## **II. The MBA Leadership Course.**

### **A. General Precepts and Organization.**

- **Given the mission of The Citadel School of Business Administration [“to educate and develop leaders of principle to serve a global community”], the course teaches the art of leadership and encourages students to seek positions of leadership.**
- **It is both an academic and a developmental course.**
- **Course organization: Borrowing on the Army’s precepts about leadership of “Be, Know, Do,” the course assumes that leaders need to be people of character; know themselves, their dossier, and how to lead; and then act (or Do!) to improve organizations and the lives of others. The blocks of the course reflect this organization.**
- **Discussion questions and lesson reflections are handed out for each class.**
- **Heavy use of group work in class based on the discussion questions and the reflections**
- **Brief (not longer than 30 minute) professor reflections on the readings. I heavily use my own experiences to amplify and provide real examples of leadership.**
- **It is heavily based on students reflecting on their personalities, backgrounds, strengths, and aspirations. They do an “elevator speech” and a career visioning exercise and also write up a statement containing their values, mission, 3-year and 10-year visions, and upcoming action steps.**

**B. Personality Instruments.**

- **Myers Briggs Type Indicator.**
- **On-Line Learning Style Survey.**
- **Johari Window.** [A openness to communication instrument.]
- **On-Line Emotional Intelligence Inventory.**
- **Using book by Goldman, et.al., reflect on their indicators of emotional intelligence.**

**C. Assigned Readings. Four books and 14 Harvard Business Review articles on leadership. See attachment.**

**D. Guest Speakers.**

**At 12 of the 14 lessons there is a guest speaker who is or has been the senior leader of an organization. [Example: Lonnie Carter, CEO of Santee Cooper; Bill Stevens, former Vice Chair of Deloitte and Touche; and Emil Lansu, former CEO of Bayer Crop Science].**

**Speakers have one hour with the students to speak and answer questions.**

**E. Class Sequence. 14 lessons once a week.**

## **F. Graded Requirements.**

- **Reflective paper of seven pages: requires use of five instruments to assess students' personality strengths and weaknesses and considers how to deploy themselves as leaders.**
- **Final paper of 15 pages to review what students have learned in the course, how they expect to deploy their strengths in the future to effectively lead organizations, and the strategies they expect to employ.**
- **Oral presentation of no more than five minutes on a leadership topic and ideally part of the final paper.**
- **Class attendance.**
- **Oral participation.**

### **III. The Undergraduate Leadership Course. A brief overview.**

#### **A. General Precepts and Organization.**

- **Given the mission of The Citadel School of Business Administration, we seek in this academic course to teach about leadership.**
- **Group work in class answering discussion questions in the text.**
- **Brief (not longer than 30 minute) professor reflections on the readings. I heavily use my own experiences to amplify and provide real examples of leadership.**
- **There are three assigned personality instruments and students do a statement containing their values, mission, 3-year and 10-year visions, and upcoming action steps. They also have to do an “elevator speech.”**

#### **B. Assigned Readings. One textbook and 14 articles from the Harvard Business Review and Leader to Leader. See attachment.**

- **Films and guest speakers are used as cases and the bases for four three-page papers.**
- **Last term I used two films.**
- **Last term there were three guest speakers.**

#### **C. Class Sequence. Two lessons a week for 27 lessons.**

#### **D. Graded Requirements.**

- **Four three-page papers on the personality exercise, films and on guest speakers. Students are asked to use their readings as the theory in applying what they learned in their personality exercise, saw in the films or heard from the speakers.**
- **One oral presentation of seven minutes of some article on leadership from The Harvard Business Review.**
- **Quizzes. Four unannounced, multiple-choice/true-false quizzes are used to check that they are reading.**
- **Mid-Term and Final Exams containing written requirements handed out in advance and in-class and a lengthy multiple-choice/true-false in-class exam over their readings.**
- **Oral participation is graded. Class attendance is taken every day and graded.**

#### **IV. My Questions of You.**

**A. What should I do to improve the graduate course?**

**B. What suggestions do you have for the undergraduate course?**

#### **v. Your Questions for Me.**



## Assigned Readings for Leadership Courses

### Graduate Course:

#### Books:

1. Warren Bennis and Burt Nanus, 2<sup>nd</sup> Ed., Leaders: Strategies for Taking Charge (New York: Harper, 1997)
2. Lee G. Bolman and Terrence E. Deal, Reframing Organizations: Artistry, Choice, and Leadership, 3<sup>rd</sup> Edition (San Francisco: Jossey-Bass, 2003).
3. Max De Pree, Leadership Is An Art (New York: Dell, 1989)
4. Daniel Goleman et. al., Primal Leadership: Realizing the Power of Emotional Intelligence (Boston: Harvard, 2002)

Articles: most of these are distillations of books. All are contained in a reader.

1. Deborah Ancona, et. al., "In Praise of the Incomplete Leader," *Harvard Business Review*, February 2007, pp. 92-100.
2. Joseph L. Badaracco, Jr., "We Don't Need Another Hero," *Harvard Business Review*, September 2001, pp. 120-126.
3. Warren Bennis, "The Seven Ages of the Leader," *Harvard Business Review*, January 2004, pp 46-53.
4. Marcus Buckingham, "What Great Managers Do," *Harvard Business Review*, March 2005, pp. 70-79
5. Robert B. Cialdini, "Harnessing the Science of Persuasion," *Harvard Business Review*, October 2001, pp. 72-79.
6. Jim Collins, "Level 5 Leadership: The Triumph of Humility and Fierce Resolve," *Harvard Business Review*, January 2001, pp. 67-76.
7. Peter Drucker, "Managing Oneself," *Harvard Business Review*, March-April 1999, pp. 65-74.
8. John J. Gabarro and John Kotter, "Managing Your Boss," *Harvard Business Review*, pp. 92-99.
9. Ronald A. Heifetz and Donald L. Laurie, "The Work of Leadership," *Harvard Business Review*, January-February 1997, pp. 5-14.
10. Frederick Hertzberg, "One More Time: How Do You Motivate Employees?" *Harvard Business Review*, January 2003, pp. 87-96.
11. Jon Katzenbach and Jason Santamaria, "Firing Up the Front Line," *Harvard Business Review*, May-June 1999, pp. 107-117.
12. Jim Loehr and Tony Schwartz, "The Making of a Corporate Athlete," *Harvard Business Review*, January 2001, pp. 120-128.
13. Henry Mintzberg, "Covert Leadership: Notes on Managing Professionals," *Harvard Business Review*, November-December 1998, pp. 140-147.
14. Jeffrey Pfeffer and Robert I. Sutton, "The Smart-Talk Trap," *Harvard Business Review*, May-June 1999, pp. 135-142.

## Assigned Readings for Leadership Courses (continued)

### Undergraduate Course:

#### Books:

Alexander J. Dubrin, Leadership: Research Findings, Practice, and Skills, 5<sup>th</sup> Ed., (Boston: Houghton, Mifflin, 2007)

Articles: most of these are also in the MBA course. Students get them by downloading from The Citadel Library.

1. Ancona, Deborah, et. al., "In Praise of the Incomplete Leader," Harvard Business Review, February 2007.
2. Collins, Jim, "Level 5 Leadership: The Triumph of Humility and Fierce Resolve," Harvard Business Review, January 2001.
3. Drucker, Peter, "Managing Oneself," Harvard Business Review, March/April, 1999.
4. Gardner, Howard, "The Ethical Mind," Harvard Business Review, March 2007.
5. Goffee, Robert and Jones Gareth, "Why Should Anyone Be Led By You?" Harvard Business Review, September-October 2000.
6. Goleman, Daniel, "What Makes a Leader?" Harvard Business Review, January, 2004.
7. Heifetz Ronald, and Laurie, Donald, "The Work of Leadership," Harvard Business Review, January-February 1997.
8. Hill, Linda, "Becoming the Boss," Harvard Business Review, January 2007.
9. Katzenbach, Jon and Santamaria, Jason, "Firing Up the Front Line," Harvard Business Review, May-June 1999.
10. Kellerman, Barbara, "How Bad Leadership Happens," Leader to Leader, Vol 35, Winter 2005.
11. Kotter, John, "What Leaders Really Do," Harvard Business Review, December, 2001.
12. Lencioni, Patrick, "The Trouble with Teamwork," Leader to Leader, Vol 29, Summer 2003.
13. Pfeffer, Jeffrey and Sutton, Robert, "The Smart-Talk Trap," Harvard Business Review, May-June 1999.
14. Uldrich, Jack, "Leading into the Unknown," Leader to Leader, Vol. 33, Summer 2004.

## **BIOGRAPHY**

### **COLONEL W. EARL WALKER, Ph.D.**

Dr. W. Earl Walker is Professor of Management and Leadership at the Citadel. He retired in July 2007 as the Founding Dean of the Citadel School of Business Administration. During his tenure, he and the faculty developed a new mission and vision for the School of Business Administration, created an 28-person Advisory Board, and started a 146-person mentors program, a Leadership Forum, the Citadel Business Hall of Fame, completely reorganized the School, raised nearly 4.0 million dollars for the School, and formed partnerships with organizations in the Lowcountry of South Carolina. He has also served as the President of The Rotary Club of Charleston and on the Boards of many organizations in the Lowcountry to include the Charleston Regional Alliance, the Charleston Breast Center, the Free Enterprise Foundation, and the Harbour Club. Previously he served as Dean and Professor of the Helzberg School of Management at Rockhurst University in Kansas City, Missouri and Dean and Professor of Management in the School of Business at Our Lady of the Lake University in San Antonio, Texas. In these positions he led business schools that redesigned themselves to include new mission and vision statements and initiated such new initiatives as an Information Technology Leadership Program, MBAs in Health Care and Electronic Commerce Management, and a Center for Leadership.

Previously he was Director of Training at McLane Company in Temple, Texas, a wholly owned subsidiary of Wal-Mart. In that position, he started the McLane Leadership School and established company-wide management training initiatives for this \$6 billion dollar company. He was also Professor of Public Policy, Program Director, and Division Chair in the Department of Social Sciences at West Point for 18 years. In addition he was a line Army officer who commanded armor units in Vietnam, Germany, and the United States and was airborne and ranger qualified. He retired in 1993 as an Army Colonel after 26 years of service.

He was a 1967 Distinguished Graduate (summa cum laude) and Phi Kappa Phi from the U.S. Military Academy at West Point and has a Ph.D. in Organizational Behavior and Political Science from the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts. He has received a number of distinctive awards to include selection as a White House Fellow and a NATO Research Fellow. He was elected by former Fellows as President of the White House Fellows Association and Chairman of the Board of the White House Fellows Foundation. He has won research grants from the Ford Foundation, the Army Research Institute, the Supreme Commander of all NATO forces, the Comptroller General of the United States, the National Guard Bureau, and the National War College. Also, he is the author of three books and numerous articles on leadership, organizations, defense policy making, the presidency, and Congress. Most of his publications are based on extensive interview research including auditors at the General Accounting Office and foreign government and military leaders in Europe. His books are: Changing Organizational Culture: Strategy, Structure and Professionalism in the US General Accounting Office; Reserve Forces and the British Territorial Army: A Case Study for NATO in the 1990s; and National Security and the US Constitution. He teaches leadership and management at The Citadel.

As an Army officer, he graduated with distinction from every level of military schooling through the National War College. He is certified as a master trainer by Zenger-Miller and is a graduate of the Wal-Mart Walton Institute. He has attended the Harvard Graduate School of Education's Management Development Program and the Center for Creative Leadership's Leader Development Program. Finally, he has actively served four Episcopal congregations since he joined the Church in 1982 as a senior warden, vestry member, lay duties coordinator, lay reader, and chalice bearer.

Earl has been married to Susan Porter Walker for over 40 years, and they have two children, Allen and Kathryn. Susan has a Masters Degree in Library Science and has served as an archivist, medical librarian, and a children's librarian. She is a Master Gardener, docent at the Edmondston Alston House in Charleston, was a docent at the Nelson Atkins Museum of Art in Kansas City and at the San Antonio Museum of Art and a tour guide for West Point Tours. Her father was an Army General, and she has all over the world. Our son is a Regular Army Major and daughter a student at Michigan Law School.

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## **ET Phone Home: PDAs in the Workplace**

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### **Abstract**

Organizations are experiencing a cultural shift to ‘continuous connection’ as a result of an increasing reliance on electronic devices to perform work at any time of day. Changing expectations about when and how employees work have both positive and negative ramifications that are important to managing organizations effectively. Though electronic devices can increase our productivity, their use in ‘off-time,’ especially by non-exempt employees, can be in conflict with regulations set by the Fair Labor Standards Act. This paper addresses three questions: Does the government need to revisit new workplace realities and re-define current distinctions between exempt and non-exempt employees? How can employers prevent unfair practices and limit potential liabilities? Can we continue to expect that employee productivity will remain high if employees are connected continuously to their work through electronic devices?

### **Introduction**

In the past decade, more and more employers have equipped their employees with personal digital assistants (PDAs), so much so that the devices are now commonplace in the work environment (Carlson, 2007). In addition to the use of these ‘smart phones’ during regularly scheduled hours, there has been a shift to using email, phone, internet, and other electronic services to stay connected to work at any time of the day. In an

increasingly competitive environment, we use them to stay connected to our clients, thus reinforcing customer service; we stay connected to our work colleagues to problem solve and engage in planning; and we stay connected to resources that provide quick access to information for our plans and proposals. In many ways these electronic devices have increased our productivity. We work in our cars, as we walk across the parking lot, as we wait in line at the grocery store (often to the annoyance of those in close proximity), while we're waiting for flights at the airport, and during our evenings and weekends at home. In fact, we use them just about anywhere at any time. In addition to phone and email services, PDAs provide us with electronic calendars, calculators, video recorders, cameras, address books, word processors, radio, and even Global Positioning System (GPS) capability (Blackberry and iPhone use may lead to overtime, 2008).

This cultural shift to an expectation of “continuous connection” has converged with an economic reality – the increase of unemployment and the subsequent concerns over job security. In the words of the New York Employment Law Letter “all of this results in a perpetual workplace in which employees at all levels find themselves working harder and longer hours to stand out in the crowd.” (August 1, 2008) And it's not just managers who are engaged in this “perpetual work.” In fact, a recent article in the Wall Street Journal (Sanserino, 2009) described the uptick in lawsuits related to hourly employees' compensation for “time spent responding to work calls or emails” after normal work hours (p. B1). Similarly, Samuels (2008) predicted that PDA use during off hours will likely “spark the next wave of employment lawsuits. Many “...employees who access their e-mails on these devices during off hours are demanding “ pay for this extra work

(Samuels, 2008). In addition, Keyes and Fife (2009) addressed these same overtime concerns by outlining the case of *Rutti v. Lojack Corporation*. The court ruled that if off-the-clock activities were indispensable parts of the job then the time spent IS compensable unless it is determined to be *de minimis* (*Lindow v. United States*).

Based on past as well as pending court decisions, several questions arise: Are employers compensating fairly these workers who are connected continuously to work through PDAs and other smart phones, especially if those employees fit the definition of non-exempt under the Fair Labor Standards Act (FLSA)? Does the FLSA provide adequate guidance to protect both employees and employers as we embrace this new definition of the workplace? If it does not, what new policies should be developed, including whether we need a new definition of exempt and non-exempt employees? How can employers protect themselves from potential liability for unjust/illegal actions that can occur when current policies become outdated by new realities? Will productivity eventually reach a point of diminishing returns if we continue to require employees to use PDAs and other electronic devices for the purpose of working harder and longer hours?

This paper will examine whether the government needs to revisit new workplace realities and re-define current distinctions between exempt and non-exempt employees. Of particular concern are non-exempt employees who are required to use their PDAs or other electronic devices/computers for work in addition to their regular forty hour work week. Additionally, we will discuss steps that employers can take to prevent unfair practices and limit potential liabilities. And finally, we will discuss a perspective that,

even if companies are protected by FLSA, they cannot continue to expect that employee productivity will remain high if employees experience high stress – or burnout - as a result of diminished down time.

Does the government need to re-define current distinctions between exempt and non-exempt employees?

Although the FLSA of 1938 has provisions for minimum wage, maximum hours, child labor, and record keeping, it is the overtime provisions that are salient to our discussion. The basic regulation in this original act states that, if an employee who is *not exempt* (i.e. hourly employees) works more than forty hours in a week, he must be paid time and a half for those hours. In 2004, the FLSA overtime regulations were overhauled. At the heart of the changes was modernizing or updating the tests to distinguish between exempt and non-exempt employees. Currently, the distinction between exempt and non-exempt employees rests primarily on position descriptions. Exempt employees are not covered by the overtime provisions and include most professionals, comprising bona-fide administrative, executive, professional, outside sales, or certain computer positions. (Gomez-Mejia, Balkin, & Cardy, 2010). These employees are referred to often as white collar workers (S. Carrol and S.R. Miller, 2004). On the other hand, all manual laborers (blue collar workers) and first responders are considered non-exempt and are entitled to overtime benefits (Honoree, Wyld, & Juban, 2005).

In addition to job descriptions, salary considerations are used to distinguish between exempt and non-exempt positions. Exempt employees must earn a pre-determined

salary, and this salary must be no less than \$455 per week or \$23,660 per year, and the salary cannot be reduced because of quantity or quality of the work performed (C.W. Von Bergen and W.T. Mawer, 2005). Jobs earning less than \$455 per week (\$23,660 per year) may NOT be classified as exempt (i.e., from overtime and minimum wage provisions) (Carroll & Miller, 2004).

The charts below – copied with some revisions from Von Bergen and Mawer (2005, pp. 223-224) outline the requirements that must be met before employees can be characterized as exempt from protection under FLSA.

Tests to Qualify as Exempt Position	
<i>Tests</i>	<i>Description of Provision</i>
Salary-basis Test	Employee is paid a set salary
Salary-level Test	1. Employee is paid minimum of \$455/week or \$23,660/year 2. Computer employees paid a minimum of \$455/week or \$23,660/year or \$27.63/hour. 3. Highly compensated employees are designated as those Earning \$100,000 - They perform “office or non-manual” work, and - They regularly perform any one or more of the exempt duties, i.e., executive, administrative, or professional
Duties Test	Exempt status defined by duties according to specific employee categories: executive, administrative, professional, computer employees, and outside sales.



<i>Employee Category</i>	<i>Tests Required</i>
Executive, Management,  Business Owner	Salary basis; Salary level; and Duties tests: regularly directs two or more full-time employees; has authority to hire, fire, or influence the status of the same FTEs; manages a recognized department or subdivision.  Salary basis; active in management and owns at least 20% equity interest. Salary level test does not apply.
Administrative	Salary basis; Salary level; Duties test: Performs office or non-manual labor that is not on a manufacturing production line and uses discretion and independent judgment.
Professional	Salary basis; Salary level; Duties test: Learned professionals, creative professionals, and teachers who perform office or non-manual labor. Some exceptions exist in the medical profession to the salary or fee-level requirement
Computer Employees	Salary level at \$455/week and a fee level that requires at least \$27.63/hr: job titles include computer systems analyst, programmer, software engineer or similarly skilled employee; consults with client for needs analysis; designs, develops, and implements computer systems based upon either user specifications or machine operating systems or combination thereof. Unnecessary to exercise judgment or discretion.
Outside Sales	No specific salary basis or salary level. Duties include: making sales and receiving pay from a client or customer and regularly engaged away from employer's place of business making sales or contracts.
Highly Compensated Employees	Paid at least \$100,000/yr where they regularly perform duties of executive, administrative, or professional employees. *
	*First responders (police, fire fighters, paramedics, etc.) entitled to overtime no matter how highly paid.

The requirements concerning kind and amount of compensation are relatively straightforward, though there are specific exceptions spelled out in the FLSA that employers should pay attention to, however, the definition of duties for those employees labeled as white collar workers is less clear. A major concern is the definition of duties for exempt 'administrative' employees, those whose primary duties are the "performance of office or non-manual work directly related to the management or general business operations of the employer or the employer's customers...and whose primary duty includes the exercise of discretion and independent judgment with respect to matters of significance" (Federal Register, 2004, as quoted in Von Bergen and Mawer, 2005). Defining the boundaries of 'discretion and independent judgment with respect to matters of significance' is the ambiguous phrase. It is conceivable that an employer may define an employee as exempt because she uses independent judgment about 'matters of significance,' but these 'matters' have only limited financial or strategic consequence. The authors have first-hand knowledge of situations where a manager convinced the human resources department to re-classify non-exempt workers as exempt to avoid overtime pay even though their duties did not change and the majority of their decisions, especially ones with budgetary implications, had to be approved by their supervisors. When qualifiers are left to interpretation, it sets the stage for legal challenge. To address this ambiguity, FLSA needs to be updated to more clearly define the kinds of decisions that qualify as matters of significance.

A glaring omission in the FLSA requirements is the use of compensatory time, telecommuting or flex time arrangements. These new practices have resulted from the

increasing use of electronic devices that enable employees to be connected to work from anywhere. FLSA regulations need to be updated to recognize these new working arrangements and provide guidance to managers who are using them.

At this time, employers are left to their own discretion regarding the upper limit on the number of hours that exempt employees work. As long as organizational leadership is paying attention to the potential and real negative effects of continuous connectivity and long work days, organizations should be able to manage effectively. If they do not pay attention and expect employees to work longer hours with an intense work load without adequate down time, the FLSA may have to be revised to protect exempt workers as well.

Steps that employers can take to prevent unfair practices and limit potential liabilities.

According to Calvasina, Calvasina, and Calvasina (2009), employers have “a great deal of latitude if they develop policies within the bounds of the FLSA and DOI Guidelines, effectively communicate them, and consistently apply them.” It is important, therefore, that employers implement standard procedures to protect themselves from liability regarding employee compensation practices, as follow:

1. Employers must review their exempt employee classifications to ensure they meet the requirements set out in the revised FLSA (2004) and Department of Labor Guidelines. If there is discrepancy between the FLSA requirements and the employer’s practices, the employer should revise its practices immediately. Periodically, employers should audit their job classifications, payroll practices,

- and record keeping to ensure policies that provide on-going compliance with government regulations.
2. Employers should develop clear policies and document them in a policy document that explains overtime restrictions, breaks and meal periods, methods for documenting hours worked, etc.
  3. If the employer has questions about FLSA compliance issues, the employer should research those questions in the literature provided by the Department of Labor (e.g. [www.wagehour.dol.gov](http://www.wagehour.dol.gov)) or seek guidance from an employee benefit professional.
  4. Employers should provide orientation forums to new employees and periodic HR workshops for all employees to review the policies.
  5. Managers should receive training on the policies, including exceptions and special circumstances. All supervisors must understand the basics of the Fair Labor and Standards Act.
  6. Managers and supervisors should monitor and enforce all policies.

In addition to policy considerations some organizations have put in place practices to support employees who are more subject to overload and to overusing PDAs. Some of these practices include (1) being mindful of how much and how often employees are encouraged to use PDAs and whether there is an unfair assumption of continuous connectivity, (2) placing limits on when non-exempt employees can use the devices after hours, and (3) including a discussion of workload and the use of PDAs in regularly scheduled performance reviews.

Can we continue to expect that employee productivity will remain high if employees are connected continuously to their work through electronic devices?

Whether an employee is classified as exempt or non-exempt has direct negative ramifications for employers if they do not adhere to the ‘time at work’ policies outlined in FLSA, however, the ramifications go beyond policies, regulations, and the law. Any employee in any position is at serious risk of burnout if there is no ‘down time’ away from work demands. Burnout is defined as a “state of physical and/or emotional exhaustion that results from unrelenting stress. Burnout occurs when a person has been involved in a frustrating or intensely demanding situation for a long time without adequate rest and recreation.” (<http://www.denvergov.org>, 2009) Many employees have times when they must work longer or more intensely, and such times are not a problem unless they become year-round with no time to recover. (About.com, 2008)

The term ‘burnout’ was coined in 1974 by Herbert Freudenberger who defined it as “the extinction of motivation or incentive, especially where one’s devotion to a cause or relationship fails to produce the desired results.” (Freudenberger, H. and G. Richelson, 1980) Employees who do not set boundaries – or who feel that they have no power to set boundaries – and continuously overwork are at high risk for burnout.

When burnout occurs it manifests itself in the workplace through any of several possible symptoms including loss of motivation, absenteeism, tardiness, emotional outbursts, dissatisfaction, turnover, health problems, and/or an increase in mistakes or reduced productivity. When these symptoms occur, organizations pay the price through increased

costs and decreased revenues. Few businesses can afford to ignore the negative effects that result when employees are continuously overworked.

An expectation of continuous connectivity that enables perpetual work without an appropriate balance of personal and work roles sets the stage for an unhappy, unproductive employee. When employees feel that they must check email at all times and may use instant messaging systems to enhance their ability to have ‘real-time’ connection, they may momentarily feel more productive, but over the long term, accumulated stress can have harmful effects on the individual’s ability to achieve peak performance as well as on personal health and family relationships.

In an Australian study in 2006 by The Organisation for Economic Co-Operation and Development (OECD), 42% of professionals and managers reported high levels of work load (reported in [www.worklogic.com.au/news](http://www.worklogic.com.au/news)). “Of the large samples of employees who participated in the survey, the majority (69%) extended their work day and worked from home into evenings and weekends,” and these workers were 3.6 times more likely to give priority to their work role than to their family role. (<http://stats.oecd.org>). Though these individuals felt compelled to work more hours and to work from home, the high workload culture appeared to be counterproductive because they had increased absenteeism due to physical, mental, or emotional fatigue and decreased commitment to their employer.

## Conclusion

ET, the fictional visitor from outer space in a movie of that same name, used technology very effectively to let his family know that he was stranded on Earth. In similar fashion, technology in the form of personal electronic devices is assisting people in ways we couldn't imagine just a short time ago. Use of these devices has become routine in the business world and has enabled flexibility, real-time communication, and more efficient transactions as individuals strive to have personal and professional success. There is a down side, however, and this down side must be considered along with the myriad advantages. Employers must pay attention to the legal and work ramifications of an environment that encourages unreasonable workloads that are sustained through the use of technology.

The Fair Labor Standards Act was developed to protect employees by regulating the way they are paid. FLSA requires that most employees in the U.S. be paid at least the federal minimum wage and receive pay at one and one-half times the regular rate for all hours worked over 40 hours in a work week. Though the salary tests for defining exempt and non-exempt employees are clear, there is ambiguity in the requirement that administrative personnel are exempt if they are salaried employees who are paid above a certain amount and if their duties comprise discretion and independent judgment. If FLSA were updated to re-define the parameters of discretion and independent judgment, boundaries in employee classifications would be clearer, employers would be faced with less ambiguity, and employees would be protected better. In addition, FLSA needs to be updated to include guidance on the new, technology supported work environment that includes telecommuting, flex time, compensatory time.

Employers are at risk of lawsuits if they expect employees to be available at all times, if the hours accumulate to more than 40, and those employees are covered by FLSA regulations. Employers must understand the laws and develop policies and management practices that adhere to those regulations. As continuous connectivity becomes the cultural norm, these regulations may need to be adjusted to also protect employees not currently covered by FLSA.

Equally important is the issue of productivity. In a fast-paced, highly competitive environment, employees are faced with working harder than they've worked before, often by using technology to remain connected to work from home. As they face long stretches with no down time, performance will very likely degrade. When employees, whether exempt or non-exempt, feel the need to be connected to their work every day during evenings at home, on weekends, and during holidays, all of their roles can be diminished, both at work and in their personal lives. It would serve employers well to develop standard operating principles that recognize this possibility and support all employees' efforts to maintain a sensible balance in all their roles, both personal and professional.

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# **HOW SOCIAL NETWORKING OUTLETS ARE CHANGING THE WAY WE APPROACH CRISIS COMMUNICATIONS: LESSONS LEARNED FROM THE RECENT BLOG STORMS**

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## **ABSTRACT**

New media outlets have eclipsed the role of traditional media as a means of communicating relevant information to organizational stakeholders. The emergence of social networking outlets has changed the way those in crisis communications, particularly public relations practitioners, must approach their duties. Social networking outlets include blogging websites, Facebook, YouTube, MySpace, and Twitter. This paper examines the role of social networking outlets as it relates to the crisis communication function. Of particular importance is the emergence of blogging, and its impact on a crisis. Implications for management are offered.

## **INTRODUCTION**

The success of crisis management, including disaster preparedness, response, mitigation, and recovery depends to a large degree on communication that is effectively disseminated to all appropriate stakeholders. The field of crisis communications is changing dramatically due to more people turning to online news sources and various social networking sites for information. Social networking outlets include blogs, text messaging, Twitter, Facebook, MySpace, and video websites such as YouTube. Because the line between print and electronic media is blurring, the area of crisis communication, a sub-area of crisis management, is in a state of dynamic transition [24].

Online social networking was once considered a niche communication outlet; today it is rapidly evolving into a just-in-time source of real news [14]. Both news and rumors can spread rapidly via blogs and the various social networking outlets. Even traditional print and broadcast media are joining the shift by adding instant push messaging, blogs, as well as links to social sites of their own.

Traditionally, crisis communications has followed a format whereby the management of the organization affected by the crisis event calls a press conference and submits statements at pre-arranged times to the media and the general public. However, with the onslaught of social networking tools, the field of crisis communications is poised for change. Despite the fact that some companies now post special statements on their organizational websites to provide updates on a crisis, the use of social networking tools as a crisis communication vehicle has been largely overlooked [16]. In addition, management has been aloof to learning about crises through social networking tools. Some companies have found out quite unexpectedly, that their products or

employees have been the source of crisis, only by learning about the event through a social networking outlet. Blogs are especially important for management to be aware of since they can attract negative news [4]. The new media can serve as a vehicle for misinformation that quickly spreads into a crisis situation if left unchecked.

In this paper, we look at the impact of social networking outlets on the management function of crisis communications. We begin by overviewing what social networking are and how they are linked with crisis events. Next, we describe how the area of crisis management has traditionally approached its communication function. We then review several high profile cases whereby news of an organizational crisis emerged through a social network outlet. With each case, we offer a "lesson learned". We conclude this paper with implications for management, particularly those who have responsibilities in the area of crisis communications.

### **The Impact of Social Networking Outlets**

Social networking outlets are specific types of websites on the Internet that promote communication among friends and web surfers who have some type of common interest. Such outlets include the popular MySpace, Twitter, and Facebook websites. In addition, there are numerous blogging sites that exist which are set up like a diary, and archive the thoughts and opinions of the blogger.

Within the various social networking outlets are instant messaging services, photo sites, and interactive maps. One of the more interesting outgrowths of social networking tools has been their use in crisis communication. Managers must prepare to harness and exploit the opportunities provided by these new digital mouthpieces. For example, social networking tools were used during the October 2007 wildfires in Southern California. The advantage they offered was the ability to communicate news that was not available on national or even local news outlets. Updates on the progression of the fires, the availability and location of emergency shelters, and the opening or closing of businesses and schools were available in almost real time through social networking outlets [22].

Social networking offers the advantage of being able to disseminate information, even if the organization's website becomes inoperable. Such was the case after a tornado hit Union University, a small private college in western Tennessee. The February 2008 storm caused damage to several campus buildings and consequently, knocked out the university's website for several hours. Despite the lack of an operating website, a blog was set up at to provide updates on the damage and recovery. In addition, the university was able to use its Facebook page to share news updates [17].

A more recent example of social networking outlets and their ability to communicate quickly occurred with the January 2009 Hudson River landing of US Airways Flight 1549. The first photo that occurred of the aircraft in the river came through Twitter, a microblogging tool [1].

Those in crisis management should educate themselves on the various ways social networking outlets can be used to augment crisis communication. Unlike the organization's websites, which

need staff with specialized skills to setup and operate, social networking tools are easy to manage. They also differ from the traditional one-way communication approach practiced by most organizations facing a crisis. The new social networking outlets incorporate a participative environment that requires consistent monitoring and timely responses during a crisis situation. Moreover, the tone of the messages, including the language structure and attitude, when engaging stakeholders within the new networking tools will be different from the traditional methods of delivering crisis information [12]. The new tools offer synchronous and recorded two-way conversation. This ability enhances both positive and negative aspects of an organization's relationship with its stakeholders in a crisis situation. Also of special interest to crisis managers is the impact of blogging, which will be discussed next.

### **The Impact of Blogging**

Blogs are a significant medium with estimates claiming massive growth with over 100,000 new blogs established each day. A blog has been defined as "frequently modified web pages in which dated entries are listed in reverse chronological sequence" [15, p. 1]. Blog tools usually have the following characteristics:

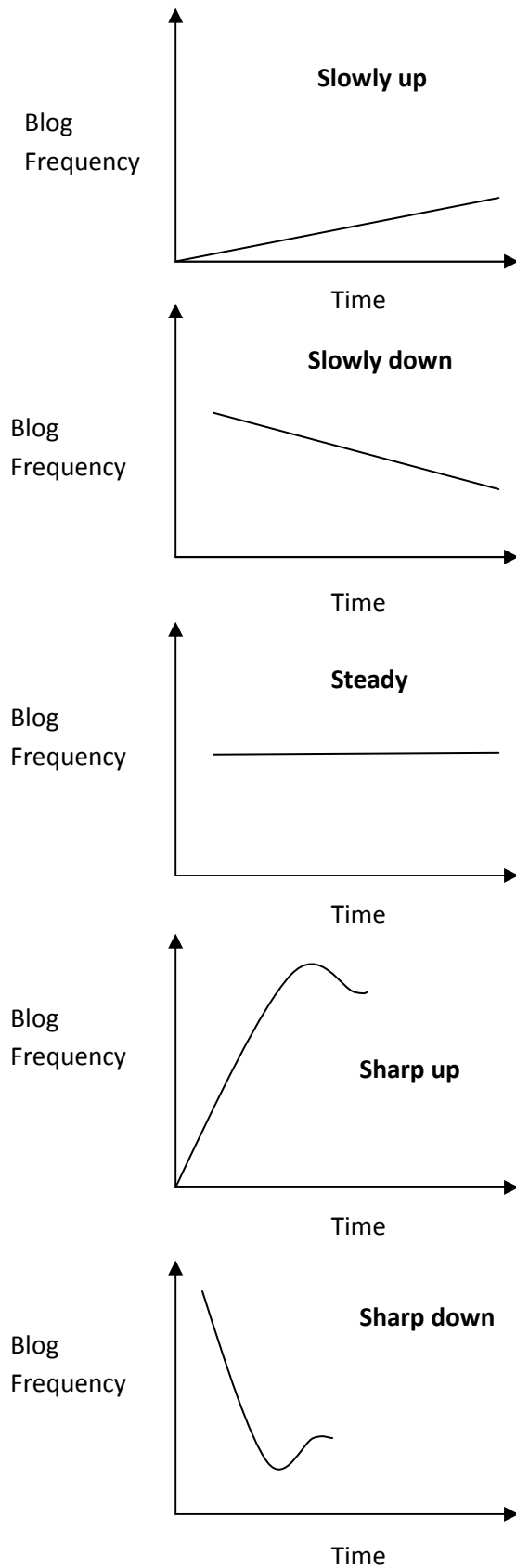
- blog visitors can express their opinions on the blog itself
- tracking capabilities that allow the blogger to see traffic related to his/her original blog entry
- permalinks which allow blog sites to be linked with each other [13].

It is this last tool that differentiates blogs from regular web pages [19].

Because of its ability to convey negative news and opinions, blogging should have special importance to those in crisis communications [4]. Bloggers can effectively report on local crisis conditions and even provide useful information, or they may contribute to the formation and escalation of the crisis. Bloggers who have large followings can reach a large audience in a short period of time. These online audiences can then turn around and convey their thoughts and opinions on a topic or event to their online friends and colleagues.

Blogging activity can be depicted on a chart, as illustrated in figure 1. The figure shows five potential patterns, with frequency depicted on the Y-axis and time depicted on the X-axis. The frequency variable indicates that a blog on a specific topic has appeared on the Internet. In charting blog activity, any combination of these five patterns is possible.

**Figure 1- Typical Blog Patterns**



Source - Guo, X., Vogel, D., Zhou, Z., Zhang, Z., & Chen, H. (2009). Chaos theory as a lens for interpreting blogging. *Journal of Management Information Systems*, 26(1), 114.

## **Crisis Management**

“A crisis is an event that has a low probability of occurring, but should it occur, can have a vastly negative impact on the organization. The causes of the crisis, as well as the means to resolve it, may not be readily clear, nonetheless, its resolution should be approached as quickly as possible,” [9, p. 4]. As this definition indicates, a crisis can have a devastating impact on the organization. Crisis management seeks to prevent these unfortunate events from occurring. In the event that a crisis does occur, management efforts focus on mitigating the impact of the crisis.

One of the key functions of the organization’s crisis management team (CMT) is to communicate effectively to its internal and external stakeholders [2] [7]. In the past, traditional crisis management practices recommended using a single spokesperson who would communicate to the media via regularly held press conferences. This practice insured a proactive, yet controlled response on the part of management; with the emphasis on making sure the company’s story and viewpoints were communicated clearly to the media.

With the advent of the Internet, many managers are finding that their organizational web page can be an effective means of communicating with employees and other stakeholders [25]. When a crisis hits, details of the event and its effects on consumers, employees, and the community can be posted. As an example, school systems use this approach to alert students and parents of class cancellations due to inclement weather.

Research at the Colorado University at Boulder - Natural Hazards Center into how the public receives information during disasters shows that it is changing from reliance on traditional sources like official spokespersons, and instead turning to social networking outlets. For example, during the 2007 shootings at Virginia Tech found that between Facebook and Wikipedia, the complete list of victims was correctly compiled before Virginia Tech officially released information [21].

The Internet also alerted companies to the fact that a crisis can begin, at least in terms of its dissemination, online. Therefore, monitoring what others are saying, particularly those with perceived authority or popularity are important. Diligent Internet surveillance can serve as an early warning detection system, particularly to emerging problems. The example that follows offers an early glimpse into this phenomenon.

### **Looking Back: The Case that Got it All Started - The Infamous Intel Chip Incident**

The emerging presence of the Internet in the early 1990s changed the landscape in terms of how crisis events would be communicated. One of the first major companies affected by an Internet-related crisis was Intel, when its flawed Pentium chip was introduced in 1994. The crisis began when math professor Thomas Nicely at Lynchburg College in Virginia found a computer error when he was working with a math problem. He e-mailed a colleague on the matter and soon his spreadsheet problem showing how the Intel chip could incorrectly calculate certain problems had spread all over the Internet [26].

A wave of negative publicity followed when Intel required that customers wishing to return their computers had to call a 1-800 number and talk to an analyst to see if the flawed chip would actually harm their work [5]. It was thus, the return policy, not the flaw in the chip, which created the negative backlash with the public. Shortly thereafter, a wave of complaints surfaced on the Internet. Intel had thus become one of the first victims of substantial negative Internet publicity, a phenomenon known as flaming.

Lesson learned – The Internet is now a new factor on the crisis management landscape.

The Intel incident was the first example involving a major company being criticized on the Internet because of a product defect. In the section that follows, we look at five recent examples involving major companies experiencing crises events that were intensified through communication via social networking outlets.

### **Lessons Learned from the Recent Blog and Online Video Storms**

A number of high profile companies have encountered negative Internet publicity due to a crisis of some type. In the discussion below, we discuss several of these incidents and the lessons that were learned from them.

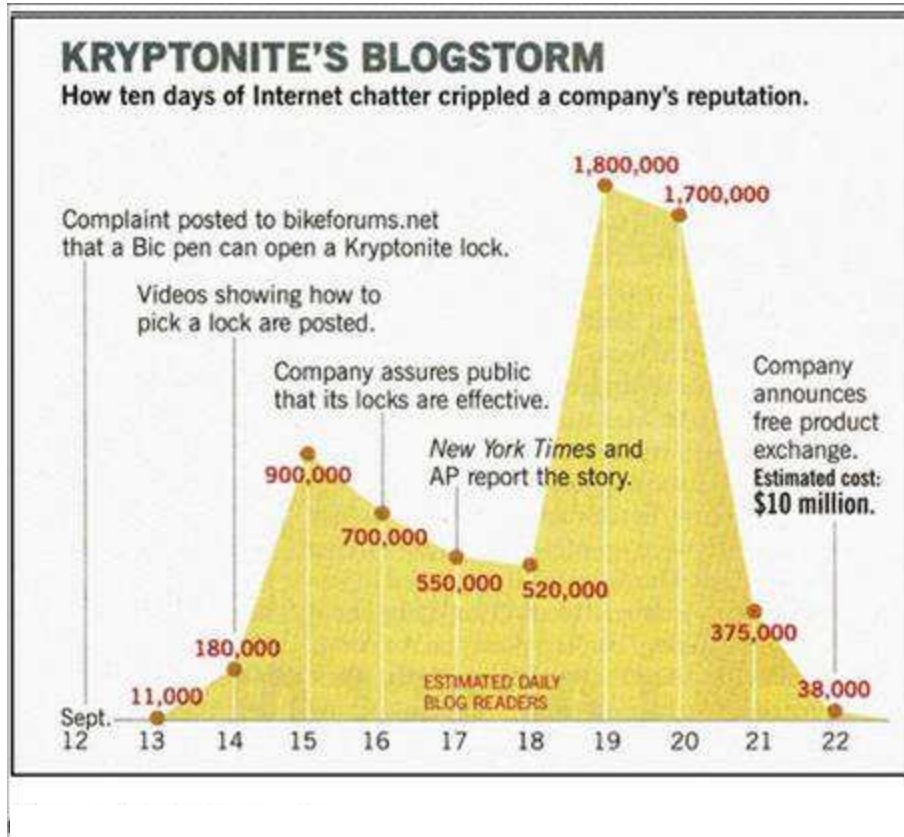
#### **The Kryptonite Bicycle Lock Incident**

In some cases, companies have discovered a product they offered was defective, only after reading about it on the Internet. This was the case for Kryptonite, a maker of heavy-duty locks for bicycles and motorcycles. In September 2004, negative Internet publicity resulted when it was revealed, via an online video, that using the cap of a Bic ballpoint pen could open the company's locks. In just a few days, the company faced enormous negative publicity, resulting in a recall of the locks and an estimated \$10 million in lost sales revenue [18].

Figure 2 depicts the blog activity for this crisis. Using the terminology from Figure 1, the reader can see a “sharp up” movement on September 14, only two days after the video was posted on the Internet. An even greater sharp up movement occurs on September 18, a day after an article in the New York Times is published. The crisis, at least in terms of blog activity, appears to be resolved on September 22, when the company announces a free product exchange.



Figure 2 – The Anatomy of a Blog Crisis



Source - Kirkpatrick & Roth, & Ryan (2005, January 10). Why There's No Escaping the Blog. *Fortune*, 151(1), 43-50.

Lesson learned - Monitor the Internet on a regular basis and look for potential crisis events that may involve your organization. What makes this case unique is that the company was not aware of the problem until they learned about it through the Internet.

### Dell Hell

In 2005, Jeff Jarvis, an influential blogger, wrote about his experience with poor customer service at computer giant, Dell. The negative attention was read by thousands on the Internet, and caught the eye of the media as well. The result was negative publicity damage for the computer maker [10].

Dell responded slowly at first, but eventually hired a specialist to work on the company's blog efforts. The company worked at improving its customer service and communicating these efforts online through its own blog. Michael Dell even caught up with Jarvis at a social gathering and apologized for the company's poor customer service performance [6].

Lesson learned – Use blogging in turn to respond to negative Internet publicity.

### **Home Depot's Time Waster Comment**

In March, 2007, Home Depot was the target of an onslaught of negative publicity when MSN money columnist Scott Burns stated that the company was a "consistent abuser" of the customer's time. Within hours, the comment section to MSN was soon filled with similar stories from customers who were tired of the poor service they were receiving due to cutbacks in store staff. In just a few hours, there were over 10,000 angry emails and another 4,000 posts criticizing the company for its poor service [6].

CEO Francis Blake responded by also going online and apologizing for the poor showing of the company. He promised to improve staffing and even thanked Scott Burns for his critique.

Lesson learned – negative news on the Internet can travel exceedingly fast and can often originate from just one single source. In this event, influential columnist Scott Burns, triggered this crisis.

### **The Motrin Fashion Statement**

In November 2008, Johnson & Johnson placed an online ad featuring a voice over of a mom saying she carries her baby in a sling because it makes a "fashion statement". The ad also said these slings caused back pain, hence, the need for Motrin pain reliever. A small group of online moms saw it differently and complained via Twitter that the ad was offensive. The moms also vented their outrage on YouTube with a nine-minute response, leaving the company with the option of pulling the ad shortly after its airing [16].

In this event, Johnson & Johnson chose to stop the ad, even though the negative response to it was quite small. "Mommy bloggers and Twitterers make up a fraction of a fraction of the U.S. population. Twitter attracts about 0.15% of the online population. It just happens that a large number of that 0.15% work in advertising and media. A not-insignificant number of mommy bloggers have worked in advertising or media. In essence, this was a ready-made media firestorm" [27, p. 12].

Lesson learned – Even though the backlash may not be staggering, it is never a good idea to offend the customer.

## The Dominoes YouTube Incident

In April 2009, two Dominoes employees posted a video on YouTube showing one of the employees sticking cheese up his nose and then putting it on a sandwich. The video received nearly one million views before it was finally taken off of YouTube [3].

Dominoes responded aggressively by posting its own video on YouTube featuring Patrick Doyle, President of Dominoes USA, apologizing for the incident: “Although the individuals in question claim it’s a hoax, we are taking this incredibly seriously,” he said, also adding that the company is revamping its selection processes so that “people like this don’t make it into our stores” [3, p. 4]. In addition to the YouTube video, Dominoes also opened a Twitter account to communicate with its stakeholders.

Despite its slow response, over 24 hours, before posting to YouTube, Dominoes was praised by public relations experts for its tactics in handling the crisis. In fact, several cited this event as a landmark case in crisis management [3] [16].

First lesson learned – It is not just blogs that can get a company in trouble; YouTube can be the source of a crisis. YouTube offers the feature of graphically portraying the event, which can be replayed over and over. Companies that employ young people may be more vulnerable to this type of crisis.

Second lesson learned – There is some merit in the old adage – “learning to fight fire with fire”, in this case, using YouTube to counter a YouTube induced crisis.

### Implications for Management

The impact of blogging raises a number of implications for management. These are overviewed in the discussion below.

**1. Organizations should utilize social networking outlets, particularly blogs, to address crisis events.** The corporate crisis management team should have a responsibility to communicate, or have on retainer, social networking specialists ready to mobilize as quickly as possible in case of a problem. Social networking tools can then be vehicles to respond to events that involve the company. The company blog helps give the organization an approachable human face [18]. It should be remembered that a blog is more personal than the organization’s webpage. Blogs are dynamic and aimed at the more human side of Internet audience. Corporate web pages are stable and meant to showcase the company’s products, services, and to some degree, its history.

However, it should be remembered that the blog must be used to address those relevant events in order to be effective. Gillen [11] cites examples of companies that did not use their blogs to address the economic crisis that has been major news for the past 18 months. Instead, the companies under study choose to talk other issues unrelated to the crisis. “In some cases, the silence was deafening. On September 29, as the Dow capped a three-day decline of nearly 800 points, Wal-Mart chose to devote an entry to clarifying its digital rights management policy.

Wells Fargo, which describes its Guided by History blog as ‘bridging events in the past with an outlook on the future,’ bypassed the opportunity to draw contrasts to the Great Depression. Instead, it devoted the day’s entry to the difficulty of finding a good wireless Internet connection” [11, p. 10].

**2. Organizations must think in terms of responding publicly to a crisis within minutes, rather than hours.** It is no longer sufficient for a company to publically respond to a crisis within 24 hours, a standard that has existed among PR practitioners [10]. “Thanks to the growing presence of blogs, wikis and instant messenger services, you don’t have a whole day to strategize that first response” [10, p. 13]. The new standard is to respond quickly, preferably within one to two hours at most. Using social networking outlets is one way to achieve this quick response. At a bare minimum, the organization should make a response on its company website as well.

Particular attention should be paid to the message development. The traditional approach was designing the organization’s messages for delivery to various stakeholders via a third-party, in most cases a journalist. However, using social networking tools requires the crisis manager to function in the role of a journalist that has to communicate the message directly to all audiences. Furthermore, a corporate tone such as typically found in an “official” press release posting will not usually be appropriate using social networking media.

When corporate websites are also used, it should be noted that some companies prepare special websites, called “dark sites” that can augment the regular website when a crisis occurs. These special websites can provide quick updates on the status of the crisis and how the company is responding to it [23]. The dark site can provide a space for frequently asked questions (FAQs) about the crisis. Examples of potential questions might include where to return a defective product, what the safety record is for the company, or the latest status on a recall effort. Proctor & Gamble used its website successfully when it was suggested that its scent freshener product, Febreze, could kill pets. To address these rumors, the Febreze website included a section that addressed these charges. The website also provided a link to an urban legend website that elaborated on the nature of the rumor [8].

**3. Organizations should utilize search engine optimization (SEO) programs to move Internet searches to the first page.** Traditional SEO measures the ranking in an average consumer’s Google search on an item such as a company name. In the event of a developing crisis event involving an organization, the organization’s website might not have been on the first page of a search. This is because news websites or other social networking sites have crowded out the organization’s website, making the negative news appear first on the page. This situation puts the organization at a disadvantage right away because their side of the story is not being told.

Utilizing SEO programs helps to move the company’s web pages and input to the first page of a search where it belongs. When conducting an Internet search, many users only view the first page and few go on after that [4]. While SEO programs cannot prevent a crisis, they can help mitigate its impact, at least in terms of reaching the Internet audience.

**4. Organizations should study blog activity on the Internet to determine potential problem areas that may exist.** Various tools such as searching on Google's Blogs and Who's Talkin' can be used to find out the degree of influence of what is being said about a company and who is saying it. Standard practice should be the monitoring of really simple syndication (RSS) feeds, as well as search terms and hashtags (for company name or a crisis issue) using search.twitter.com. A handful of organizations now exist that can help managers chart blog activity relating to a specific company or crisis event. Utilizing these companies and examining blog activity can yield insights on factors associated with a crisis and to what magnitude it is being communicated via the Internet [13].

Figure 2 presented earlier is a chart of a specific event involving one company. The activity actually follows two waves of blogging publicity. The first after a video was posted and the second after the New York Times article. The chart clearly shows that it was the Times article that is linked with the most blog activity.

**5. Organizations should remember that they might never satisfy every individual stakeholder.** The principles of disaster communication remain the same within the new capabilities of social networking media. These principles include providing transparency, accessibility, trustworthiness and reliability in terms of information exchange. Nevertheless, there are some stakeholders who will never be appeased; no matter what the organization does to appease the stakeholder involved. Johnson [16] maintains that those involved in public relations interventions need to be aware of the difference between a dissatisfied customer (who can eventually be satisfied) and a troll (who will never be satisfied). "Dissatisfied customers can be approached personally and want to change their minds about something. Trolls are only satisfied by bigger fights. Bloggers have learned to ignore trolls ... PR professionals must develop the same skill – pick your battles" [16, p. 24].

Moreover, any disclosures by corporations must be within any legal and regulatory guidelines. This means that the content of messages through social networking should be checked by the legal counsel or department to avoid inadvertent admissions that could cause additional problems.

## CONCLUSION

The emergence of social networking outlets has changed the way those in crisis management, particularly public relations practitioners, must approach their duties. Social networking outlets include blogging websites, Facebook, YouTube, MySpace, and Twitter and have changed the communications environment dramatically. Public relations practitioners must learn to communicate faster in the event of a crisis, often in just a matter of minutes. Companies may now be forced into a crisis situation in the time it takes to click a mouse. An option to respond expediently is to use the same outlets that often communicate a crisis to begin with. This means responding to a blog, via a blog, to a YouTube video, via a YouTube video, and so on.

Public relations practitioners would also do well to learn to study blog activity and understand how news about a crisis travels via the Internet. In addition, learning to use an SEO program

will be helpful in moving the organization's online crisis responses to the front page of an Internet search. Finally, despite their best efforts, it will not be possible to satisfy every person that is affected by the crisis. The age-old adage of picking your battles applies to responding to blog, online videos, and the like.

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**PRESENTER PASSION AND PRESENTATION DESIGN ON REVIEWER  
ASSESSMENT: AN EMPIRICAL STUDY OF GRANT PROPOSAL  
PRESENTATIONS FOR A DEPARTMENT OF DEFENSE GRANTING  
AGENCY**

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**ABSTRACT**

This study examined the formal presentations of ten firms seeking funding from a technology transfer agency for the Department of Defense. Utilizing several different scales, coders viewed the video-taped presentations. The analysis indicated that both the perception of the presenters' "passion" during the presentation and a clearly defined formal introduction to the presentation were positively related to the expert panel's assessment of the technology and ultimately funding.



## INTRODUCTION

Selecting which commercial proposal to support is one of the most fundamental challenges confronting those involved in making funding and other resource support decisions. Both public and private organizations partake in this exercise, typically making use of a formal review as part of the investment decision-making process -- private equity investors typically use formal screening protocols when evaluating technology-based business plans, university technology transfer offices employ formal reviews when deciding whether to invest in patent and commercialization activities, corporate R&D departments include formal review as part of their stage-gate product development procedures, and granting agencies formally review R&D proposals prior to awarding grants [1] [17] [15].

The process of selecting appropriate investment opportunities typically involves several distinct stages, each in sequence. Oftentimes the first decision stage involves reviewing a number of written business plans, project summaries, or detailed executive summaries that have been submitted to a screening committee. A number of studies have examined this initial screening process from a variety of perspectives [10] [21]. Although this first stage filtering process may be highly formalized [18], there is also a general recognition that additional information and discussion may be needed prior to an actual investment decision. Hence, a second stage screening process is oftentimes added where applicants are allowed to present to a panel of experts (or other decision makers) in order to provide more detail about their business plan and technology. Typically, following the proposal presentation, the panel will discuss and ultimately

“vote” upon the proposal [18]. In the case of angel investors, this presentation might be during the network’s monthly meeting where several applicants would present their business model sequentially, each seeking investment commitments. In the case of grant applications, the applicants also are often asked to present before a panel of domain experts, with a number of applicants presenting their proposals during the same day.

Regardless of the setting, this second stage presentation of early investment opportunities typically involves a formal oral presentation, then a Q&A period followed by some sort of formal or informal vote by the panel or investors. A few researchers have provided general descriptions of these early stage investment decision discussion processes [18]. However, most of these descriptive studies of investment discussions have been subjective in nature involving small sample sizes, and few, if any prior research has objectively measured the perceptual changes during these second stage presentations.

The idea behind incorporating a panel discussion following the second round presentation stems from a key premise of the group decision-making literature, that groups have the capacity to make better decisions than lone individuals because of the superior informational resources available to them [4] [14] . Specifically, in our case, heterogeneous panels composed of subject matter experts whose expertise is derived from different aspects of entrepreneurial technology transfer initiatives are given the opportunity to discuss the merits of a proposed endeavor prior to making final funding recommendations. The process of discussion ought to permit all panel members the opportunity to make use of one another's expertise when evaluating the merits of a proposed endeavor, thus improving the potential they will make valid predictions of venture

performance. This premise, however, hinges upon the notion that teams will effectively share their unique expertise/information during discussion allowing them the opportunity to capitalize on their informational superiority.

A complicating factor for groups evaluating complex decisions involves determining which decision cues are most relevant to the analysis in question. For example, in predicting the future commercialization potential of early stage technologies, questions arise as to which factors are most relevant. Arguments can be made regarding cues related to such areas as market readiness, technology readiness, commercial readiness, and management readiness [13]. Accordingly, granting agencies tend to construct reviewer panels comprised of varying types of experts such as technical experts, equity investors, bankers, entrepreneurs and professional service providers. Each type of expert is expected to bring his or her own knowledge and experience sets to the table and offer insights that other members of the group may not have considered.

Related research also suggests that groups do not always make effective use of the knowledge/informational resources available to them [22]. Rather, they tend to discuss information that is known and/or agreed upon by all members instead of sharing knowledge/information members uniquely possess, invariably resulting in decisions of poorer quality (i.e., the biased informational sampling model) [23]. The tendency toward biased information sampling results in part from a group's desire to quickly reach consensus [19]. Although consensus resulting from a thorough discussion and evaluation of available information does result in superior decisions [20], consensus that is derived from the desire to

quickly arrive at agreement and/or to avoid conflict, does not always enhance decision quality, and sometimes detracts from it [24].

In addition, there is a broad literature, particularly in the communications field, to suggest that the design, sequencing, and implementation of a technical presentation will influence the perception of the underlying project's potential [5] [8]. The underlying argument in this literature is that an audience, or decision making group, will filter and interpret the various cues provided during the presentation based to some degree on their perception of the technical aspects of the presentation and the style of the presenter. Clark (2008), makes this point, suggesting an important distinction be made between managing the content of a presentation and the technical design aspects of a presentation, and that both aspects can impact an audience's perception during a technical presentation. Chen et al (2009), for example, found that private equity investors' perception of an entrepreneur's "passion" and "preparedness" during a formal presentation influence their funding decision. Andeweg et al (1998) argue that an introduction, even a short one, makes audiences more willing to listen to a professional presentation, while Gerritsen and Wannet (2005) reports significant cultural differences in the appreciation of the introductions of presentations. In Angel investor funding presentations, Sudek (2007, 2009) has found evidence that the perception of the entrepreneurs "ethics" and "trustworthiness" significantly influenced investors' interest in a proposal.

## **RESEARCH QUESTION**

Based upon the recent communication literature, the primary research question investigated in this study was whether or not the form and style of the presentation influenced an expert panel's

assessment of the merits of a technology during a formal 2<sup>nd</sup> round presentation process for grant funding.

## **METHODS**

### **Sample**

This research study examined technologies assessed by a congressionally-funded Department of Defense (SPAWAR) technology transfer agency (Center for Commercialization of Advanced Technologies, CCAT) that has a specific mission of funding technologies being developed by small private sector R&D firms, government and defense research agencies, and university laboratories that have a homeland security application. In addition, due to the Department of Defense's interest in supporting market sustainable technologies, there is particular interest in technologies that have a "dual use" capability in the commercial market. For example, a waterborne bio-warfare agent detection technology may also have a much broader commercial application as a water quality monitoring device for local water districts.

Proposals for funding are received and reviewed approximately three times per year by this particular agency. The funding process goes through the typical two stage screening process previously described. The first stage is a review and scoring of the detailed written applications by approximately five experts in the field. This process eliminates approximately 80% of the original applications. Since the primary mission of this particular funding agency is commercialization of technology, the funding application is modeled after, and very similar to detailed business plan summaries often presented to angel and VC equity investors. The application includes sections on the technology, target market description, strategies for

commercialization, previous funding (grant, equity, etc.), competition, management and scientific team backgrounds, anticipated milestones and barriers, etc.

The second stage involves an invited presentation to another panel of experts, usually between four and seven in number. This session involves a formal presentation, followed by a Q&A period, a discussion period by the panel, which in turn is followed by a final vote by the experts – again, a process very typical of the pre-due diligence business plan screening process undertaken by many private equity investment groups. Approximately 65% of these applicants are then funded based upon the final panel vote. Total funding per successful application ranges between \$75,000 and \$150,000, and is generally considered supplemental to other funding the technology might have.

The sample for this study consists of ten technologies that proceeded to the second stage screening process in 2006. The technologies are considered to be highly advanced solutions, generally in early to middle stages of technology development, ranging between proof-of-concept technologies to lab prototypes. Funding is specifically targeted to advancing the technology to the next phase of commercial development. All but one of the technologies presented and analyzed in this study were from small emergent companies, the single exception was a technology from a government laboratory. In all cases, the technology presented was the core technology being developed by the firm.

The technologies presented to this agency are classified as biometrics, communications, computers, electronics, life sciences, materials, photonics, and sensors, and can be considered

highly advanced post 9-11 technologies. Examples of the technologies presented in this particular screening round, and analyzed for this study, were “*Bioassay Control*,” “*Beryllium Detection*,” “*Fuel Cell Membranes*,” “*Wearable Flexible Displays*,” “*IDS Adaption for Intermodal Containers*” “*Novel Fuel Cells Using Anionic Membranes*” “*Image Enhancement for Miniature Cameras*,” and “*3-D Face Recognition*.” All of the technologies were considered to have dual-use capabilities for both government and commercial sectors.

Each proposal was allocated approximately one hour of time. Different screening panels of domain experts were formed based upon the nature of the technology. The 2006 review process was divided into 4 different technology panels focusing on a particular technology class, with the same reviewer membership within each technology panel. All reviewers, regardless of their professional background, had substantial experience with technology-based ventures. Not only did each reviewer report their expertise in a particular domain of technologies (such as biotechnology or robotics) prior to being asked to sit on a screening panel, but after receiving the application, the reviewers were asked to exclude themselves from the evaluation of any technology they did not feel qualified to evaluate. All the reviewers held either masters or doctoral degrees and were categorized as venture capitalists, active technical scientists/engineers, technology commercialization consultants, active entrepreneurs, and program administrators.

### **Expert Assessment Variables**

For our study, prior to the presentation the panel of domain experts formally evaluated each of the received proposals on a number of dimensions. As described above, the pre-presentation

review was therefore based solely on the detailed “business plan-like” application and proposal form. For this study, we used expert assessment variables related to technical merit, commercial potential, and ability of project team to execute plan, which directly correspond to the key dimensions reported by Heslop et al., (2001), Astebro (2004), and Galbraith and Zeznock (2008). Reviewers used an 11- point Likert scale to score each variable. Scoring was done at the individual level for each panel member. Overall, there were a total of eight expert assessment variables, and for this study we also used the sum of all eight variables as a “total” assessment. Thus within the group decision making literature, the panels’ decisions would be considered a “non-discrete” quantitative judgment, similar to that examined within the social judgment scheme (SJS) model [9] [16].

After the one hour presentation the reviewers again evaluated the technology using the same instrument; thus we had a pre- and post-presentation metric by reviewer for each technology. The post-presentation and discussion scoring was also done at the individual level.

### **Presentation Variables**

Video tapes were made of the actual presentations. Three cameras were used, one showing the presenters (and their power points/slides), one from the side angle, and one showing the panels. As mentioned above, each presentation, including Q&A was approximately one hour long. Two evaluators were used to examine the videos, and subsequently rate the various aspects of the presentation. Both evaluators were pre-trained using the questionnaire used for assessing the videos, and were advanced industrial psychology majors; each video evaluator examined the



videos separately from each other. The Pearson correlation between the two video evaluators was 0.87, indicating a high degree of agreement.

Presenter “passion” and “preparedness” were measured using an 11-item scale developed by Chen et al (2009). Chen et al (2009) report that the 6-item scale measuring “passion” had an alpha reliability of 0.95, while 5-item scale measuring “preparedness” had an alpha reliability of 0.87. Following Caricato (2000) and Sudek (2007, 2009), perception of presenter ethical/trustworthiness behaviors was measured by two items, “the presenter appeared trustworthy”, and the “presenter appeared ethical”. Perception of the “introduction” consisted of 7-items modified from Gerritsen and Wannet’s (2005) 15-item scale regarding audience “appreciation of an introduction.” Finally, the general aesthetics of the presentation were measure by 2-items -- whether the presentation was “attractive” and whether the presentation used a lot of “visuals”. All items were measured on a five-point Likert “strongly disagree/strongly agree” scale.

## **ANALYSIS**

The average of all pre-presentation scores by the expert panel was 45.58 (sum of 8-expert assessment items) while the average of all post-presentation scores was 47.32. Thus the presentation resulted in a slight, albeit statistically insignificant, upward change the total average score for the full data set; however, significant changes in the average scores of the individual technologies by the panel members were noted. The largest positive change by the experts for a presentation was 8.83 (total of all eight items), while the largest negative change for a presentation was -3.25 (total of all eight items). With respect to the individual expert assessment items, the experts’ perception of the management team showed the greatest difference between

pre- and post presentation periods, increasing from an average of 7.998 for the ten technologies prior to the presentation to an 8.356 average after the presentation.

To analyze the impact of the form and style of the presentation influenced an expert panel's assessment of the merits of a technology during a formal 2<sup>nd</sup> round presentation process for grant funding we performed a regression analysis. Explanatory variables in the regression were, a) the "passion" score (sum of 6-item passion scale), b) the single-item "attractiveness" scale and, c) whether there was a formal introduction to the presentation. Due to obvious sample size limitations we could not employ other variables in the analysis. In addition, given the highly technical content of the presentations, it was felt that the "non-technical" video evaluators could not adequately evaluate certain aspects of the presentation, such as those items in the "preparedness" scale.

The dependent variables in the regressions were changes in the pre- and post expert assessments of the technology. Four regressions were performed, three equations using changes in the expert assessments of technical merit, commercial potential, and ability of project team to execute plan as dependent variables, and one equation with changes in the total eight-item expert assessment value as the dependent variable. Table 1 provides the results of the analysis.

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Insert Table 1 Here  
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From Table 1 it appears that given even the small sample size, there is a significant relationship between the style and format of the presentation and whether or not the panel of expert evaluators changed their opinion of the technology after the formal presentation. Most

significant appears to be the perception of the presenters “passion” during the presentation. This scale (see [6]), attempts to measure components related to the presenters “intense affective state accompanied by cognitive and behavioral manifestations of high personal value” (p. 201). Perceived “passion” within a presentation involves body language, vocal pitch and tone, and gestures. In three of the four regression models, the presenter’s high perceived “passion” score was statistically related to a positive change in the expert panel assessments of the proposal. This finding corresponds directly with Chen et al’s (2009) finding that higher “passion” scores result in higher investment levels by venture capitalists.

Second, in two of the regression equations, a clearly defined formal introduction to the presentation was related to a positive change in the expert panel’s assessment. This finding is consistent with a number of studies in the technical communication literature that suggest a well organized introduction impacts the overall assessment of the following presentation [2] [12]. Finally, the overall aesthetic nature of the presentation, that is how attractive and aesthetically pleasing the presentation was, is also positively related to the expert panel’s assessment, albeit statistically significant in only one equation.

## **CONCLUSION**

There has been increased recent interest in understanding the role that the presentation format and style has upon investor decision making. Chen et al (2009), for example, found that a presenter’s perceived “passion” and “preparedness” influenced private equity investors’ decisions to invest in a project. Many grant proposals go through essentially the same phased process as a private equity screening process where a select number of proposals are invited to present their

technology to a panel of experts. And it is during this presentation screening process that decisions will ultimately be made regarding final funding for the proposal.

Using a real life decision making process, a total of ten video-taped proposal presentations to a Department of Defense/SPAWAR-SD technology transfer consortium were analyzed. In this analysis, we found that the presenters perceived “passion”, as well as the perceived “attractiveness” of the presentation and whether the presentation had a formal introduction, was related to whether or not the expert panel scored the proposal higher or lower after hearing a one-hour long presentation.

Clearly, this study must be considered exploratory. Only ten presentations were analyzed, and there were clearly degree of freedom limitations with our study. In terms of sample size, however, our study is consistent with many other communication experiments that use only a few presentation scenarios. More importantly, however, is that our study is based upon video tapes of real presentations, with real panels of expert decision makers and presenters, within real outcomes of financial gain or loss (obtaining grant funding) – analysis of real presentations made under such circumstances is rare in the literature. Given this, more insights can be gained from a larger sample size. Currently research is underway to expand our analysis.

<b>Table 1: Regression Analysis: Presentation versus Change in Expert Assessment</b>				
<i>Variables</i>	<i>Technical Merit</i>	<i>Potential for Commercialization</i>	<i>Management Team Quality</i>	<i>Total Technology Assessment</i>
Constant	-2.413	-4.354	-2.920	-15.819
"Passion"	0.110*	0.183***	0.005	0.441*
"Attractiveness"	-0.031	0.175	0.219	1.605*
"Introduction"	0.352	0.308*	0.689**	1.689
R2	0.467	0.804	0.580	0.675
N	10	10	10	10
*prob<0.10; **prob<0.05; ***prob<0.01				

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**Linking Contingency Theory with Operations Management:  
The Role of Management Improvement Programs**

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## **Linking Contingency Theory with Operations Management: The Role of Management Improvement Programs**

### **Abstract**

Traditionally, operations management has taken more of a “one best way” approach to matters related to production processes. This thinking originated under Frederick Taylor’s Scientific Management approach, which advocated a methodological approach to solving production related problems. Usually, this ended up with a prescribed, step-by-step method for carrying out a procedure. Contingency theory on the other hand, takes an “it all depends” approach to analyzing management problems. While its application to operations management appears to be sparse, in actuality, it fits well in the implementation of management improvement programs. In this paper, we discuss this linkage between contingency theory and operations management via the use of management programs such as JIT, TQM, and Six Sigma.

### **Introduction**

“There is one best way to approach a management problem.” That is one of the legacies of Frederick Taylor’s Scientific Management, which gained momentum in the early 1900s. Thanks to Taylor and others, the “one best way” approach has had an important influence on modern day manufacturing and service industries. Perhaps the biggest impact has been in the area of operations management, where efficiency and consistency of production methods is necessary.

Riding concurrently with this movement has been another wave of management thought that runs counter to the one best way approach. “It all depends” is the mantra of the contingency theory movement, which maintains that there is no one best way to approach all management problems. Contingency theory has made its biggest impact in the areas of leadership thought and organizational design. However, there is little documentation about its inroads into the area of operations management. A closer look indicates contingency theory has been working in the background all along, through the guise of management improvement programs. In operations management, contingency theory suggests the solution should fit the problem. Although this statement may appear obvious, much of the existing evidence suggests businesses do not always do the obvious.

This paper begins by reviewing contingency theory as described in the leadership and organizational design literature. We then move to discuss contingency theory in terms of a three-factor framework, a depiction we label the Contingency Triangle. With this backdrop, we posit a link between contingency theory and operations management through the implementation of management improvement programs. Such programs include a wide variety of approaches such as Just in Time (JIT), total quality management (TQM), and Six Sigma. We propose these management improvement programs offer a modern day version of contingency theory as it relates to operations management. We conclude by suggesting some implications for management.

## Background

Contingency theory operates from the assumption there is no “one best way” to carry out a task. Hence, contingency theory is “a perspective that suggests that the most profitable firms are likely to be the ones that develop the best fit with their environments” (Lester & Parnell, 2007: 20). This mindset is radically different from the influence of Scientific Management, which advocated the best method approach, particularly in the area of task design. Within the realm of management, contingency theory has progressed in two separate directions, 1) in approaches to leadership style, and 2) in approaches to organizational design.

### Contingency Theory and Leadership Style

The basic premise in the leadership literature is that the style of the leader should vary according to the demands of the leader’s particular situation. Table 1 identifies the four major theories that linked contingency theory with leadership styles.

**Table 1. Contingency Theory and Leadership Styles**

<b>Name of theory</b>	<b>Major Proponents</b>	<b>Leadership Varies According To:</b>
Situational Leadership Model	Paul Hersey and Ken Blanchard (1969)	Individual readiness of the employee
Normative Decision Model	Victor Vroom and Philip Yetton (1973)	How much participation is needed from the group
Path-Goal Theory	Robert House (1971)	What is needed to help the employee achieve their goals
Contingency Model	Fred Fiedler (1967)	The favorability of the situation for the leader

Hersey and Blanchard (1969) proposed the situational leadership model. This model maintains the leader must adjust his/her style of leading according to the readiness capabilities of the employee. Four styles are possible, telling, selling, participating, and delegating. Each style varies according to how able and confident the employee feels about the assigned task.

Vroom and Yetton (1973) proposed the normative decision model. This model is set up as a decision tree that asks a series of questions about a particular problem in the workplace. The aim of the model is to determine when the leader should solicit help from the group, and when to make the decision alone. Three options are possible, the leader makes the decision, the leader consults the group and then makes the decision, or the leader leaves it up to the group to make the decision.

House (1971) proposed the path-goal theory. This theory maintains four leadership styles are available to help employees reach their goals – directive, supportive, participative, and achievement-oriented. The appropriate style is contingent on the employee’s personal characteristics, including locus of control, and certain characteristics of the work environment, such as task structure.

The contingency model offered by Fiedler (1967) takes a different approach to leadership. This model assumes the leader to have a fixed style of leadership; therefore, that leader must seek out positions that fit the particular style. Fiedler maintains that leaders have one of two leadership styles, task oriented or relationship oriented. Consequently, the leader should not seek to adjust their style, but adjust the type of leadership assignments they seek.

In summary, each of the four contingency theories of leadership stresses there is no one best way to lead. Instead, the leadership style is contingent on the situation at hand.

### Contingency Theory and Organizational Design

In the area of organizational design, contingency theory “was an outgrowth of systems theory, and a reaction against the ‘one best way’ of organizing and managing” (Wren, 1987: 390). Table 2 summarizes the three major studies that looked at contingency theory and organizational design.

**Table 2. Contingency Theory and Organizational Design**

<b>Name of Study</b>	<b>Researchers Involved</b>	<b>Organizational Design Varies According To:</b>
Study of Technology and Organizational Design of 100 manufacturing firms in Southern England	Joan Woodward (1965)	The technology process used in the organization
Case studies of firms in the plastics, food, and container industries	Paul Lawrence and Jay Lorsch (1969)	The environment the firm finds itself in
Study describing mechanistic and organic organizations	Burns and Stalker (1961)	The environment the firm finds itself in

Joan Woodward (1965) studied technology processes in manufacturing firms in England during the 1950s. She identified ten categories of technical complexity in these firms and found that organizational structure was contingent on the type of technological production process used.

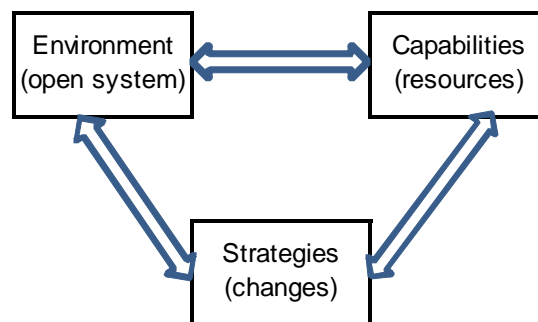
Lawrence and Lorsch (1969) were studying organizations and became concerned with the premise there was one best type of organization. After conducting an extensive study of a multi-division company, they concluded divisions were organized differently in several ways: formality of structure (formal versus informal), interpersonal orientation (task versus personal), and time orientation (short-term focus versus long-term focus). The divisions operated in different environments (stable versus dynamic). The study concluded successful divisions had different types of organizations; however, they were successful because their organization structure matched their operating environment.

Burns and Stalker (1961) outlined the concepts of mechanistic and organic organizations. Mechanistic organizations were highly centralized with top management making the main policy decisions. The structure of the organization was tall, meaning there were many managerial levels. Jobs were specialized and rigid policies and procedures were in place. On the other hand, organic organizations were highly decentralized with the main policy decisions being made at the unit level. The structure of the organization was flat indicating fewer managerial levels. Jobs were broad in scope and contained more skill variety. The jobs existed with more flexible policies and procedures in place.

Luthans (1973) suggested contingency theory could be the unifying management theory. Up until its introduction, management theories abounded, but were separate and competitive. For instance, process theory looked at the four functions of management - planning, organizing, directing, and controlling. Operations research theory (a derivation of the scientific management movement introduced by Frederick Taylor) represented the quantitative approach and evolved into the management science theory; human relations (an outgrowth of the Hawthorne studies by Elton Mayo) evolved into organizational behavior theory; and systems theory (from the physical sciences) stressed the need for interrelatedness and the interdependency of all of the component parts. Luthans contended managers could use contingency theory to take the best from each of the other theories and use them as needed.

### A Contingency Theory Framework

A simple framework illustrates how managers can view this change management challenge. Figure 1 depicts three interactive elements: the environment in which a company operates; the capabilities of the company; and the strategies they employ in matching their capabilities with their environment.



**Figure 1 - The Contingency Triangle**

The environment is analogous to the open system concept, or the elements that affect a company's operations but are beyond the direct control of the company. For example, some of the major influences on a company's strategies include competitor actions, technology advances, economic cycles, government legislation, environmental evolution, and society preferences. Each of these is continually changing and exerting pressure on a company to change.

The capabilities of a company are its abilities to cope with its environment. It is the result of past strategies and includes the resources of a company: philosophy (vision, mission and cultures), infrastructure (organizational structure, policies and practices), product line and market base, and physical resources (employees, equipment, facilities, and systems).

Strategies are the actions companies take to survive in the short term and prosper in the long term. They can be proactive - what management would like to happen, and reactive - in response to the changes in their environment. How well a company plans and implements its strategies determine its success.

Contingency theory demands a careful matching of organizational capabilities to its accompanying environmental demands. It requires precision in making changes, not necessarily adopting a pre-fitted management improvement plan for the organization. One study identified over 90 quality tools, ideas and philosophies developed in a number of quality improvement programs. The author pointed out the most successful quality improvement programs utilized tools and ideas that best fit the organization's needs as opposed to using the entire management program off the shelf (Foster 2006).

### **Contingency Theory and Operations Management**

All organizations face a changing environment, even those companies offering stable product lines and competing in less volatile markets. All products go through life cycle stages of introduction, growth, maturity and decline. As the product moves from one stage to the next, sales volume increases and product variety often stabilizes around a few basic lines. The competitive advantage moves from uniqueness and availability to lower cost and higher quality. As demonstrated in the product-process matrix by Hayes and Wheelwright (1979), the type of production process moves from a job shop orientation to a repetitive or process orientation as the product moves through its life cycle. When companies have multiple products, they usually have some in each stage of the product life cycle. Consequently, they have different production processes available to meet the needs of each product.

Martin Hahn (2007) suggests contingency theory makes it possible to draw from other management theories. He poses the following scenario. A shoe manufacturer faces decreasing profits. The company can use time studies to increase productivity of the workers (classical management theory). Management may also involve workers in improving work methods (behavioral management theory), or establish a team of sales and production personnel to coordinate sales and production (systems theory). Rather than doing all three, contingency theory stresses the need to first determine the true cause of the problem and select the action that will offer the best solution. In other words, the solution must fit the problem.

Another study focused on the use of contingency theory in developing manufacturing flexibility strategies. Flexibility implies managers are using strategies that enable them to best match their capabilities with the demands of their operating environment. The study examined how managers used different flexibility strategies to meet environmental demands, demand variability and demand predictability. The results indicated that the plants with high predictability and moderate variability were most successful when they used a reduction strategy - reduce the need

for flexibility through long-term relationships with key suppliers or customers, or by better forecasting. On the other hand, successful plants with low predictability and moderate variability used banking - build inventory ahead of demand or an adaptation strategy – to vary output to meet demand (Ketokivi 2006).

One of the more comprehensive studies focused on contingency theory research in operations management practices. It pointed out the emergence of a number of new management practices over the past three decades, such as total quality management and lean production. While these practices have been advocated as universally applicable, continued study and experience has raised doubts as to their universal validity. The studies concluded that continued research is necessary to generate knowledge about the technical fit of operations management practices to different contexts. The study indicated contingency knowledge is also important for practitioners, “because the failure to acknowledge the limits of applicability of operations management practices may lead to their application in contexts to which they are not suitable” (Sousa and Voss 2008: p. 711).

Enterprise Resource Planning (ERP) systems represent an approach that requires a company to adopt best practices, but not necessarily those best suited to the company. While ERP systems are widespread, not all users are satisfied with their results. Morton and Hu (2008: p. 391) state, “Despite the tremendous popularity and great potential, the field of Enterprise Resource Planning (ERP) adoption and implementation is littered with remarkable failures. Though many contributing factors have been cited in the literature, we argue that the integrated nature of ERP systems, which generally requires an organization to adopt standardized business processes reflected in the design of the software, is a key factor contributing to these failures. We submit that the integration and standardization imposed by most ERP systems may not be suitable for all types of organizations and thus the “fit” between the characteristics of the adopting organization and the standardized business process designs embedded in the adopted ERP system affects the likelihood of implementation success or failure.” The authors go on to identify a set of dimensions of organizational structure and ERP system characteristics that can be used to gauge the degree of fit, thus providing some insights into successful ERP implementations.

### **The Role of Management Improvement Programs:**

Management improvement programs are planned interventions that are usually assigned a separate name to distinguish them from the normal operations of the business. They are often identified by an acronym, such as Just-in-Time (JIT) or Total Quality Management (TQM). These programs help to improve some part of the business operation, such as reduce operating costs, improve product or service quality, or shorten customer response time. Usually, they are of a project nature and have a life cycle of their own, with a beginning and an end to the program.

Management programs usually originate as an attempt to introduce improvement into a business. They may be original for a particular company or they may be an adaptation of an existing program that has become popular in another company. For example, Toyota started a program to reduce inventory and improve cash flow by revamping its production system. This program, first known as the Toyota Production System (TPS), was later identified by other names, such as

stockless production and zero inventories. It achieved widespread industry acceptance and eventually became known as the Just-in-Time (JIT) system.

Some companies are finding less than satisfactory results in adopting management improvement programs because the original conditions in which the programs were most successful differed from those in the companies now trying to adopt the program (Crandall 2007). The problem appears to be an incorrect fit between the management program, and the specific needs of the business. As a result, management improvement programs do not operate under the “one size fits all” mindset. Instead, such programs are contingent on the specific area or process in the organization that needs improvement. Table 3 illustrates this relationship between the various operations management process areas and the appropriate management improvement programs. Put another way, the use of a particular management improvement program is contingent on the area of operations management to which it is applied.



**Table 3.** Contingency Theory Meets Operations Management via Management Improvement Programs

Operations Management Area	Appropriate Management Improvement Program(s)
Production Planning	<ul style="list-style-type: none"> <li>▪ Materials requirements planning (MRP)</li> <li>▪ Manufacturing resources planning (MRP II)</li> <li>▪ Enterprise resources planning (ERP)</li> <li>▪ Warehouse management system (WMS)</li> <li>▪ Manufacturing execution system (MES)</li> <li>▪ Advanced planning and scheduling (APS)</li> <li>▪ Sales and operations planning (S&amp;OP)</li> </ul>
Performance measurement	<ul style="list-style-type: none"> <li>▪ Activity based costing (ABC)</li> <li>▪ Activity based management (ABM)</li> <li>▪ Balanced scorecard (BSC)</li> </ul>
Process Improvement	<ul style="list-style-type: none"> <li>▪ Just-in-Time (JIT)</li> <li>▪ Lean production or manufacturing</li> <li>▪ Business process reengineering (BPR)</li> <li>▪ Agile manufacturing</li> <li>▪ Computer-integrated manufacturing (CIM)</li> <li>▪ Theory of Constraints (TOC)</li> <li>▪ Mass customization</li> </ul>
Quality Improvement	<ul style="list-style-type: none"> <li>▪ Statistical process control (SPC)</li> <li>▪ Total quality control (TQC)</li> <li>▪ Total quality management (TQM)</li> <li>▪ Quality function deployment (QFD)</li> <li>▪ Six Sigma</li> </ul>
Supply Chain Management	<ul style="list-style-type: none"> <li>▪ Quick response system (QRS)</li> <li>▪ Efficient consumer response (ECR)</li> <li>▪ Vendor managed inventory (VMI)</li> <li>▪ Collaborative planning forecasting and replenishment (CPFR)</li> <li>▪ Supply chain management (SCM)</li> </ul>

The original users of management improvement programs often achieve success with their implementation. However, later adoptees of such programs are not always as successful. One reason for this lack of success can arise from the incorrect matching of the program to the need of the business. A secondary problem lies in the failure to implement the program correctly (Crandall & Crandall, 2008).

## Matching the Program to Fit the Need

In discussing the incorrect matching of the program to the need, it is important to differentiate between the company that originates the management improvement program, and the companies that follow later with their own implementations of the program. The originator is the first company that successfully implements the program. If the followers using that program are also successful, it is most likely because they have an operation that is similar to the originators. Additional followers similar to the first company can implement the programs and also achieve success. As the program grows in popularity and additional success stories abound (often through articles in the popular press), other companies also implement the program. However, as the program is extended into businesses different from the originator, the level of success may vary and, in some cases, the program may actually be considered a failure. Contingency theory maintains that managers should match the program carefully with the needs of the organization.

It is important to consider the needs of the company desiring to implement a management improvement program. These needs may include considering the company's business strategy focus, product and service offerings, type of manufacturing/service process, organizational culture, industry tradition, and the degree of decision-making centralization.

**Business strategy focus.** The focus of business strategy will vary among companies. One company may focus on cost reduction while another company may emphasize quality improvement. Each company has different needs; therefore, the management program selected will differ from one company to the next.

**Product and service offerings.** Companies' product volumes and variety vary. A business that thrives on low volume, high variety products should not expect a program developed for high volume, low variety products to fit their needs. The same is true for service offerings. An inventory management program developed for widely fluctuating demand patterns, such as a seasonal retail business, is not suitable for a stable demand business, such as the dairy department of a retail grocery store.

**Type of manufacturing/service process.** Manufacturing processes are generally classified as job shop, batch, repetitive and process. Service processes have been classified in terms of the degree of customer contact, such as high contact (hospitals) versus low contact (computerized banking). Given this wide range of processes, it is difficult to apply the same program equally well to all types of companies.

**Organizational culture.** The organizational cultures among businesses can be very different from each other. Culture includes the belief systems in place within a particular organization. One of the key barometers to look at in terms of implementing a management program is the openness to change that exists with the organizational culture. It is essential that the management program be adapted to the existing culture, or the existing culture be modified to the management program, or some degree of both. Modifying an organizational culture may be more challenging than the actual implementation of the management program.

**Industry tradition.** A given industry will have its own unique origins, practices, language and peculiarities. Many improvement programs are successful because they meet the needs of a

particular industry. For example, JIT and Lean manufacturing fit the needs within the automobile industry; Quick Response systems lend themselves to the retail industry; while MRP/ERP systems meet the particular needs of industries with complex products and repetitive manufacturing processes.

**Degree of decision-making centralization.** Managerial decision-making can be classified as centralized or decentralized. In recent years, there has been a trend towards employee empowerment and decentralized decision-making (Lester & Parnell, 2007; Robbins & Coulter, 2007). The justification is that decisions can be made faster, which better satisfies the needs of customers. Centralized decision making on the other hand results in better control throughout the organization, but can be offset by slower decision-making in general. It is important that the implementation of management improvement programs take into account the differences in these two approaches to decision-making.

The foregoing discussion indicates the reasons a management program needs to be adapted to its proposed application area if it is to have a chance of success. Even when the program fits the need, companies must implement it correctly.

### Implementing the Program Correctly

A common mistake is for management to jump into the execution phase too quickly because of their desire to see immediate results (Crandall & Crandall, 2008). Because management programs are long-term projects, they warrant a careful and systematic approach in terms of implementation. The following contingencies require careful attention during the implementation stage.

- **Identifying the improvement area.** Management must first determine what actual need for improvement exists. If the need is to improve quality, a program designed to decrease costs by reducing inventory is less appropriate.
- **Selecting and/or designing the right program.** Taking the time to select those elements of the program that will fit the company's needs is necessary. For example, the concept of problem-solving teams has widespread application. On the other hand, a kanban scheduling system designed for repetitive production may not be appropriate in a process industry.
- **Creating a receptive environment.** Many employees resist change, either actively or passively, unless they have been involved in its design. As a result, a management improvement program can fail because the employees affected by it resisted its implementation.
- **Organizing for implementation.** This phase involves organizing the steps and schedule necessary to implement the plan. These decisions include how to organize the teams that will be involved; deciding whether to use consultants; determining the level of training required; and selecting the area of operations in which to pilot the program.

As the discussion above indicates, the implementation of management improvement programs is contingent on a number of factors. Contingency theory maintains that one best solution does not exist for even similarly related operations management problems. Instead, the success of such programs is contingent on internal factors within the organization, and the manner in which the program is implemented.

## Implications for Management

What can we conclude about contingency theory in relation to operations management? We believe there are several salient points to consider.

- ✓ Contingency theory may be stating the obvious, but sometimes we need to consider the obvious. Contingency theory helps us to consider carefully the alternatives before acting.
- ✓ The implementation of management improvement programs ultimately requires a project approach. This requirement means project management, involving cross-functional teams, is becoming a permanent fixture in progressive companies. Each project varies because of the different goals and activities associated with each implementation.
- ✓ Change management is a difficult process. Implementing management improvement programs remind us that while there is no one best way to enact change, an understanding of the company's infrastructure, technological processes, and organizational culture is necessary in order to fit management improvement programs with the core need.
- ✓ Contingency theory is not a superior approach to the "one best way" approach advocated under scientific management. On the contrary, the two approaches address different areas of management problem solving. One best way thinking is needed when analyzing processes that require efficiency and consistency. On the other hand, contingency thinking is useful in thinking through change management initiatives.

## Conclusion

In this paper, we looked at the linking role of management improvement programs in applying contingency theory thinking to operations management problems. During the days of Frederick Taylor and the Scientific Management movement, operations management took a "one best way" approach to addressing production processes. Contingency theory on the other hand, takes an "it all depends" approach to analyzing management problems. It is especially applicable to operations management in the implementation of management improvement programs. Such management programs are especially well suited to addressing problems in the areas of production planning, performance measurement, process improvement, quality improvement, and supply chain management.

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# **An Examination of Correlation Patterns between Entrepreneurial Attitudes and Entrepreneurial Personality Traits among College Business Students of Different Ethnicities**

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## **Entrepreneurship and Ethnicity**

As indicated in various reports from the Global Entrepreneurship Monitor (GEM) entrepreneurs are constantly pursuing new business ventures based on both opportunity and necessity. Specifically, entrepreneurship has long been considered a powerful source of economic growth and innovation (Reynolds & White, 1997). Consistent with this, research has indicated that minorities are seeking out more entrepreneurial opportunities as a way to overcome the frustration and discontent from the lack of advancement opportunities in large organizations (Weiler & Bernasek, 2001; Heilman & Chen, 2003). The current study examines the relationship between various personality constructs and entrepreneurial attitudes in two different ethnic groups of business students. The goal is to determine not only if these personality traits are correlated with entrepreneurial attitudes, but also if any ethnic differences exist in the patterns of correlation.

The study of entrepreneurship may include consideration of numerous contextual factors, including both environmental and individual characteristics. Past areas of focus for entrepreneurial research have included geographical location, regional policies, access to resources and support programs, family history, educational levels, personality traits, attitudes, ethnicity, and gender. The current study considers three of these individual factors, specifically personality, attitudes, and ethnicity.

The entrepreneurial sector can be an important source of future opportunity for minority groups. Prior research has indicated that the skills and techniques of minorities need more development in order to achieve greater levels of future success. While this is a pressing problem, it is equally important to gain a better understanding of the factors associated with entrepreneurial attitudes of young African American adults in order to determine their future entrepreneurial intentions. Entrepreneurial ventures not only benefit individual investors, but also serve to improve overall market efficiency and innovativeness.

Before addressing potential obstacles historically faced by African Americans in regards to business ownership, it is first important to understand the importance of entrepreneurship for minority groups. 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).

From a legal perspective, the passage of the Small Business Act has impacted the number of minorities who have considered entrepreneurship as a viable career choice. The Act proposes a relationship between training courses and small business development, which suggests that the actual and potential capacity of small business is encouraged and enhanced by the use of training (Martin, Wech, Sandefur & Pan, 2006). 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).

## **Personality, Attitudes and Entrepreneurship**

### ***Entrepreneurship and Personality***

Management research has made extensive use of psychological personality variables as predictors for constructs such as leadership, organizational behavior, and entrepreneurship. According to Rauch and Frese (2007a), personality variables serve an important role in the development of a consistent entrepreneurship theory. As such, they call for the inclusion of entrepreneurship as a more “active participant” in the revival of personality research (p. 44). The current study makes an effort to do that by examining the role of individual differences in relation to entrepreneurial attitudes.

Prior research has examined numerous personality constructs in the field of entrepreneurship, and various traits have been linked to business creation and success (Rauch & Frese, 2007a). McClelland (1961) and Collins, Hanges & Locke (2004) asserted that need for achievement is an entrepreneurial trait and positively correlated with business success (Rauch & Frese, 2007b), while Gasse (1985) and Hansemark (2003) found that entrepreneurs often possess a greater internal locus of control. Research also suggests that entrepreneurs are confident (Robinson, 1987), have a high level of self esteem and self efficacy (Krueger & Brazeal, 1994; Erickson, 2002; Rauch & Frese, 2007a; Frazier & Niehm, 2006), demonstrate greater initiative (Bateman & Grant, 1993; Stewart, Watson, Carland & Carland, 1999), and possess a more positive attitude toward risk and autonomy (Douglas & Shepherd, 2002; McMullen & Shepherd, 2006; Rauch & Frese, 2007a). In addition, creativity (Feldman & Bolino, 2000; Zampetakis & Moustakis, 2006), innovation (Rauch & Frese, 2007b) and improvisation (Hmieleski & Corbett, 2006) have been linked to entrepreneurial intentions and business success.

Obviously there are numerous personality constructs that have been shown to have potential for predicting either entrepreneurship or entrepreneurial success. The current paper will focus on four of these which have either shown promise in previous research in terms of being associated

with entrepreneurship or are constructs which are highly consistent with the definitions of the entrepreneurial attitudes of interest.

### *Locus of Control*

As a construct, locus of control is associated with how individuals perceive environments, events, and the causes of these circumstances (Rotter, 1966). Individuals with an internal locus of control believe they are able to control what happens in their lives, whereas individuals with an external locus of control attribute life events to factors outside of their control such as fate, luck, or powerful others. Both Robinson et al. (1991) and Hansemark (2003) concluded that entrepreneurs had higher internal control expectations than do non-entrepreneurs. Entrepreneurs face constant challenges, and the belief that one is able to control or handle a situation is often required to overcome various obstacles (Amabile, 1983).

### *Self Efficacy*

Bandura's (1997) construct of self efficacy is defined as people's judgments of their capabilities to execute necessary behaviors to successfully achieve desired ends. It is not necessarily concerned with the skills or abilities one has, but rather with perceptions of what one can do with the skills and abilities one possesses. Self efficacy has both theoretical and practical implications for entrepreneurs because initiating a new venture requires the belief that one has the knowledge, skills, and abilities necessary to be successful. Entrepreneurial self efficacy has been found to be significantly related to both entrepreneurial intentions (Kickul & D'Intino, 2005) and new venture creation (Frazier & Niehm, 2006). Self efficacy is central to most human functioning, but because actions are based more on what people believe they can do than on what is objectively true, self efficacy should be a strong correlate of entrepreneurial attitudes (Markman, Baron & Balkin, 2005).

### *Perseverance*

The perceived ability to overcome adverse circumstances (Stoltz, 1997) has long been considered a requirement of entrepreneurship. According to Eisenberger and Leonard (1980) perseverance influences individuals' courses of action, the level of effort individuals exhibit in their endeavors, and the endurance and resilience exhibited toward setbacks and failure (Markman, Baron, & Balkin, 2005). Markman (2007) proposes that the general ability to overcome adversity is a required competency in entrepreneurship because of the repeated obstacles and uncertain outcomes encountered. Supporting this contention, Markman, Baron, & Balkin, (2005) concluded that because individuals react differently to similar adversities, success in entrepreneurship contexts is determined by the extent to which individuals persevere despite what appear to be insurmountable obstacles, or adversities (Stoltz, 1997).

Similarly, Locke and Baum (2007) consider perseverance to be among the motivating factors which are necessary for entrepreneurship. Their conceptualization of entrepreneurial motivation is synonymous with the concept of perseverance - an inner drive toward entrepreneurship goals that energizes, directs, and sustains new venture creation and growth.



## *Variety Seeking*

Efforts to explain innovative behavior are now focused upon not only dispositional variables, but also the interaction of individual and situational variables (Burns, 2007). The degree to which one has a high motivation to experience variation has been linked to many human behaviors, including consumerism (Mittelstaedt, Grossbart, Curtis & DeVere, 1976; Jinhee, Kyu Kim, Incheol, & Youjae, (2006); Wahlers, Dunn, & Etzel, 1986; Workman & Johnson, 1993), food preferences (Potts & Wardle, 1998), and internet preferences (Slater, 2003), among others. Pre-dating the term variety seeking – and typically considered the primary direct source of it – is the concept of sensation seeking, or desire for “varied, novel and complex sensations and experiences, and willingness to take physical and social risks for the sake of such experiences” (Zuckerman, 1979, p. 10). This definition is in many ways akin to how we typically describe an entrepreneur, as someone who is willing to undertake risk in the process of beginning a new business enterprise. Variety seeking is also thought to develop from indirect or situational sources, and this too is consistent with many characterizations of new venture creation. Specifically, not all motivations for variation arise from an internal preference for change, but rather some develop from the desire to solve a problem, or as reactions to changes in the environment (Van Trijp, 1995). For some entrepreneurs the motivation to attempt something new is very much a response to situational factors including dissatisfaction with current work, inadequacies identified in current products, or other unique opportunities which present themselves.

## *Entrepreneurial Attitudes*

An attitude is “a complex mental state involving beliefs and feelings and values and dispositions to act in certain ways” (attitude, n.d.). Attitudes tend to change across time and situations through an interactive process with the environment, and can offer a prediction about a person’s future actions (Carlson, 1985). The work of Robinson, Stimpson, Huefner, and Hunt (1991) was one of the first to use an attitudinal scale to predict entrepreneurial activity. They designed the EAO model to measure entrepreneurial attitudes based on the constructs of achievement, innovation, personal control and self esteem. Achievement in business refers to concrete results associated with the start of a business; personal control of business outcomes concerns one’s perception of control or influence over his or her business; innovation in business relates to acting on business activities in novel ways; and perceived self esteem in business relates to self confidence with regard to one’s business affairs.

The theory of planned behavior argues that intention is an antecedent to behavior (Ajzen, 1991), and prior studies have shown that intentions play a crucial role in understanding the entrepreneurial process (Shapero & Sokol 1982; Krueger, 1993; Krueger & Brazeal, 1994). Shapero and Sokol (1982) argue that attitudes are linked with entrepreneurial intentions, especially in perceived venture feasibility and desirability. Additional research found that positive entrepreneurial exposure can impact intentions (Krueger, 1993), though this may vary according to individual characteristics and situations (Krueger & Brazeal, 1994).

### ***Historically Black Colleges and Universities (HBCUs)***

A target area for collecting data for this study was students from Historically Black Colleges and Universities. HBCUs have played a crucial role in the rise of black entrepreneurship. These institutions have been “seats of black progress” because of their supportive campus environment and open opportunity structures (Bennett & Xie, 2003). Research on the graduates supported by the United Negro College Fund have reported high levels of satisfaction with HBCUs and have frequently stated that they have prepared “them well for participation in society” (Butler, 1991). It additionally observed that the upward economic and social mobility of HBCU graduates is, in many respects, reminiscent of the experiences of immigrant ethnic groups that have pursued the American Dream through higher education and entrepreneurship (Butler, 1991).

Evaluating the relationship between attendance at HBCUs and those who become successful entrepreneurs reveals two opposing viewpoints. From one perspective, many believe that native-born African Americans have failed to develop a tradition of entrepreneurship for a variety of reasons, most notably the lack of opportunities to gain experience in “buying and selling” (Frazier, 1949), a dearth of business “success symbols” (Foley, 1966), and the absence of a cultural heritage (Light, 1972). Thus, this viewpoint embraces the idea that successful African American businesses is one of a tradition of successful individuals, rather than one based upon a collective experience (Light, 1972).

Another perspective examining the relationship between attendance at HBCUs and entrepreneurship attitudes embraces the view that a small class of mostly Southern blacks has followed a tradition of self-help and entrepreneurship, inspired by the idea, espoused by Booker T. Washington, that they could “take advantage of the disadvantages” of racial oppression (Butler, 1991). This counterargument holds that active participation in the educational, religious, and fraternal organizations of the segregated black communities of the South has been a hallmark of this select group of black entrepreneurs and that attendance at HBCUs has been central to this heritage (Butler, 1991). It suggests that the formation and continued existence of this class – particularly in the South, where blacks have faced their greatest disadvantages – have been tied closely to involvement in the institutions that its members have collectively supported, most notably HBCUs (Boyd, 2007).

### **Current Study**

To date, little research has empirically examined the entrepreneurial attitudes and intentions of African Americans, particularly young adults. In fact, despite their recent increased involvement in business ownership, past research has indicated that minorities tend to be less optimistic overall in their expectations of business success (Carter, 2000), and are more likely to fail when starting a new venture (Carter, Williams & Reynolds, 1997; Boden & Nucci, 2000; Robb, 2002). Thompson (2004) points out that successful entrepreneurship requires a combination of temperament, talent and technique. It can be argued that temperament is first needed in order to convince African Americans of their potential in the entrepreneurial arena, and to encourage them to view business ownership as a viable career option. Thus, a stronger understanding of the entrepreneurial personality constructs and attitudes of young adults in the African American population can make an important contribution to the entrepreneurship research body. In

addition, comparing the relationships that are seen for African American students with those for Caucasian students may shed light on whether or not there exists differences in temperament which might help account for the outcome distinctions seen in the business world.

## **Method**

### *Participants*

Participants were 257 individuals (93 African American, 164 Caucasian) who were enrolled in business courses during the spring and summer 2009 semesters at several universities in the southeast U.S. The sample was 50.2% male, with an average age of 24.9. The participants came from all class levels, with the largest percentage classified as seniors (44%), followed by graduate students (30%), juniors (18%), sophomores (4%) and freshman (4%).

### *Measures*

We measured entrepreneurial attitudes with the Entrepreneurial Attitudes Orientation survey instrument (Robinson et al., 1991). The EAO is theoretically well grounded and provides a composite score based on four attitude subscales: 1) Achievement in business refers to concrete results associated with the start-up of a business (Cronbach's alpha = .84), 2) Perceived personal control of business outcomes concerns one's perception of control or influence over his or her business (Cronbach's alpha = .70), 3) Innovation in business relates to acting on business activities in novel ways (Cronbach's alpha = .90), and 4) Perceived self-esteem in business which relates to self-confidence with regard to one's business affairs (Cronbach's alpha = .73). The four subscales have been shown to produce 77% accuracy in predicting entrepreneurship (Robinson et al., 1991).

In addition to completing the EAO, participants completed additional measures of creativity, self efficacy, openness to experience, and risk tolerance (Goldberg, Johnson, Eber, Hogan, Ashton, Cloninger & Gough, 2006) and provided demographic information including gender, age, class standing, previous exposure to entrepreneurial organizations, and information related to their future entrepreneurial intentions.

### *Analyses*

Since the primary interest of the study was to examine differences between our African American and Caucasian student population's personality – entrepreneurial attitude relationships, correlations were first computed for all variables of interest. Following this, Fisher's Z test was computed to determine if the correlations were significantly different from one another.

## **Results & Conclusions**

As can be seen in Table 1 (below) very few significant differences were found to exist in the correlation patterns found between the entrepreneurial attitudes and personality constructs of interest based upon ethnicity. In fact, only for Locus of Control were significant differences found. In particular, Locus of Control was found to be significantly positively related to both

Entrepreneurial Achievement and Entrepreneurial Personal Control in the African American sample, but not in the Caucasian sample of business students.

Ironically then, what may be our most significant finding is the high degree of similarity between African American and Caucasian students. Despite two notable differences, the patterns of correlation are almost identical. Although past research has shown that minorities (Kourilsky & Esfandiari, 1997; Heilman & Chen, 2003) are faced with more obstacles in the entrepreneurial process, such as less education and business experience, limited resources, and fewer mentors and advisors, hopefully change is on the way. Our findings reinforce Brush's point (1998) that differences related to demographic factors alone are not conclusive and that a better understanding of entrepreneurial success requires consideration of the combination of personality traits, attitudes, and outside factors such as economic necessity.

Although not a primary focus of our study, it is important to note the value that entrepreneurship education can play in helping prepare African American students for success in the entrepreneurial world. Research shows that many young adults, particularly aged 25-34, are often interested in new venture creation, and individuals with post-secondary academic experience are more likely to act in an entrepreneurial manner (Minniti, Bygrave and Autio, 2006). This, combined with our results indicating that college-age African Americans already possess strong entrepreneurial attitudes, makes it critical for colleges and universities to offer entrepreneurship programs for young adults interested in business ownership. These programs can not only help them recognize entrepreneurship as a viable career choice, but also equip them with a better skill set for business development. Thompson (2004) suggests that talent and temperament are vital for entrepreneurs, and talent can be improved through participation in educational programs. If you can assess whether or not someone has the temperament to be an entrepreneur, then learning can be "relatively quick and easy" when appropriate training is provided (p. 246).

		Locus of Control Caucasian Students	Locus of Control African American Students	Perseverance Caucasian Students	Perseverance African American Students	Self Efficacy Caucasian Students	Self Efficacy African American Students	Variety Seeking Caucasian Students	Variety Seeking African American Students
Entrepreneurial Achievement	Pearson	.001	.319*	.412*	.527*	.326*	.438*	.381*	.434*
	Sig. (2-tailed)	.992	.002	.000	.000	.000	.000	.000	.000
	N	164	93	164	93	164	93	164	93
	<i>Fisher's Z Test</i>		<b>2.504*</b>		1.124		.998		.483
Entrepreneurial Innovation	Pearson	-.084	.151	.274*	.286*	.455*	.280*	.457*	.431*
	Sig. (2-tailed)	.286	.148	.000	.005	.000	.006	.000	.000
	N	164	93	164	93	164	93	164	93
	<i>Fisher's Z Test</i>		1.796		.099		1.545		.246
Entrepreneurial Personal Control	Pearson	-.039	.215*	.365*	.508*	.476*	.405*	.485*	.445*
	Sig. (2-tailed)	.617	.038	.000	.000	.000	.000	.000	.000
	N	164	93	164	93	164	93	164	93
	<i>Fisher's Z Test</i>		<b>1.956*</b>		1.348		.670		.388
Entrepreneurial Self Esteem	Pearson	.354*	.360*	.311*	.332*	.501*	.534*	.277*	.325*
	Sig. (2-tailed)	.000	.000	.000	.001	.000	.000	.000	.001
	N	164	93	164	93	164	93	164	93
	<i>Fisher's Z Test</i>		.052		.178		.343		.401

\*Significant at the  $p < .05$  level.

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BUILDING BUYER-SELLER RELATIONSHIPS WITH SELLING STRATEGIES

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## BUILDING BUYER-SELLER RELATIONSHIPS WITH SELLING STRATEGIES

### Abstract

While the value of buyer-seller relationships is unquestioned, and salespeople are acknowledged to play an important role in the development of those relationships, there is little information about which tactical behaviors by salespeople actually contribute to relationship development. In this exploratory study, we find preliminary evidence that using an agenda selling strategy, as opposed to a more typical summary-of-benefits strategy, makes it more likely that a buyer will perceive a stronger relationship with that seller. This relationship building aspect of agenda strategies may be based on the value that buyers place on the high level of information provided by the salesperson using an agenda strategy. Importantly, this relationship enhancement seems to occur even when the buyer does not choose the seller's product, making an agenda selling strategy a potentially valuable tool for achieving long term, as well as immediate, success.

The significance of successful buyer-seller relationships is evidenced by both the number and variety of relationship aspects discussed in the literature (Jap 2001; Cannon and Perrault 1999; Lusch and Brown 1996; Robicheaux and Coleman 1994; Noordewier et al. 1990; Hunt et al. 1985 ). Seminal work on buyer/seller relationships (Dwyer, Shurr and Oh's 1987) outlined a progression of stages through which these exchanges often pass. The general acceptance of this developmental approach has created a continuing interest among marketers in identifying the antecedent conditions that help to initiate or facilitate beneficial customer relationships. For example, drawing upon various theory and business practice bases, Cannon and Perreault (1999) associate a number of antecedent market and purchase situations with the respective relationship types that are likely to result from them. Other researchers have investigated the role of important antecedent behavioral norms, such as trust, and their influence on the development of long-term orientations between buyers and sellers (Ganesan 1994) or anticipated future interaction with a supplier (Doney and Cannon 1997).

Despite considerable research into antecedents of various types of buyer-seller relationships, Reid, Plank and Minton (1997) noted that researchers have, with few exceptions, ignored the more tactical behaviors of sales people and the potential of these actions to lay the groundwork for relationships. This statement holds true to date. The purpose of this current exploratory research is to address this gap in the literature. Specifically, we explore whether a particular tactical behavior, the seller's selection of selling presentation strategy, has implications for future relationship development with buyers.

*Information Exchange and Relationships.* Sales presentations hold promise as potential relationship builders because they focus on providing information to buyers. Early research into relationships in marketing often relies on Macneil's (1980) discussion of contract norms, one of which is the exchange of information that characterizes closer, more relational, interactions. Cannon and Perreault's (1999) review of buyer-seller relationships in business markets concurs and refers to

information exchange as an important “relationship connector.” Communication founded on information sharing is reported to be associated with trust (Morgan and Hunt 1994) and greater commitment between the parties in a relationship (Anderson and Weitz 1992). When surveyed, purchasing professionals report that the seller’s use of information to differentiate products from the competition is one aspect distinguishing successful from unsuccessful salespeople (Reid, Plank and Minton 1997). Finally, in a retail context, the seller’s providing of advice and otherwise imparting of knowledge has been directly related to rapport building, “the single major determinant in the long-term success of business” (Gremler and Gwinner 2008).

According to uncertainty reduction theory (Berger and Bradac 1982), the disclosure of information during an interaction reduces ambiguity and helps the individual to predict the future behavior the other party. Jacobs et al. (2001) states that the disclosure of information in the context of a selling situation helps the buyer to begin to judge the trustworthiness of the seller. Particularly important to the current research, is their finding that disclosure of information contributes to relationship development.

In their study of married couples and insurance agents, Jacobs et. al (2001) investigated the reciprocity, or balance of information shared by both buyer and seller, as a predictor of relationship potential following an initial sales interaction. Disclosures were categorized as either social or task-specific disclosures (i.e. related to the business purpose). Both the number and duration of the disclosures were measured for the dyads. Increased task-specific disclosures by the seller (but not by the buyer) related positively to the customer’s perception of business relationship potential. The duration of task-specific disclosures were significantly related to more positive perceptions of relationship potential for both sides of the dyad.

***Selling Strategies:*** The sales presentation is one of the chief ways in which the salesperson shares information with the buyer. “A sales presentation is primarily a discussion of a series of product

features connected with benefits that the buyer has indicated are important during the previous needs discovery stage ... (Dalrymple et al. 2001, p. 97).” Wagner, Klein and Keith (2001) define and contrast the effectiveness of two sales presentation strategies, the summary-of-benefits strategy and the agenda strategy. The summary-of-benefits strategy is like many traditional sales presentations with the seller providing information about the positive benefits of his or her recommended product. The focus of the presentation is the strengths of the product, with any weaker attributes omitted from the discussion or suggested to be offset by the stronger. In this selling strategy, there is no systematic discussion of the competition. The objective is to have the buyer form a favorable overall evaluation of the seller’s product and so the information provided by the salesperson focuses predominantly on the product being sold.

In contrast, the agenda strategy suggests a non-compensatory structure for the buyer’s decision (Wagner, Klein and Keith 2001). The seller encourages the buyer to apply a series of constraints, each of which leverages a strength of the target product while potentially eliminating some strong competitors from further consideration. For example, a seller whose own product has a strong reliability rating from an independent laboratory (e.g., 8 out of 10) might suggest that the buyer consider only products whose reliability is at that level or better. If the buyer accepts the seller’s suggestion, the result is a reduced consideration set that is more favorable to the ultimate selection of the target product. Similar to the summary-of-benefits presentation, the seller provides the buyer with favorable information concerning the benefits of the target product. However, the agenda additionally provides verifiable competitive information that helps the buyer make an informed decision about whether or not to apply the seller-suggested constraint, and thus eliminate some products from further consideration. In addition, this information about both the target product and its competitors may also be effective in differentiating the target product from others in the industry.

Wagner, Klein and Keith (2001) compare the agenda and summary of benefits strategies in a study of industrial buyers. They report that the agenda strategy (compared to the summary-of-benefits) results in higher product evaluations and more frequent consideration and choice of the target product. This work provides evidence that a seller making the tactical decision to use an agenda selling strategy (vs. the summary-benefits) is more likely to experience success relating to the current, or *immediate*, purchase situation. However, Weitz (1981) defines selling effectiveness as occurring *across* customer interactions. Given the importance of a longer-term perspective and the benefits attributed to stronger customer relationships, a logical question to ask about agenda strategies is whether they have the potential to enhance future selling success by cultivating a positive buyer-seller relationship.

Consideration of the central differences between the agenda and the summary-of-benefits strategies may begin to provide any answer to this important question. While both the agenda and summary-of-benefit strategies discuss the benefits of the targeted product, there are differences in the nature of the information exchanged between buyer and seller. For example, imagine the information contained in sales presentations relating to a copier purchase decision. Both the agenda and summary-of-benefits strategies may identically discuss the importance of copier reliability and reveal that an independent laboratory has rated the target product as a 6 (on a scale of 1=poor and 10=outstanding). However, the agenda strategy that suggests a constraint involving copier reliability will also provide specific information on the reliability ratings of competitive copiers, showing to the buyer which of them do and do not meet the suggested level of reliability. This information reveals to the buyer the effect of applying this constraint; that is, how many options will still be in the consideration set and which specific options they are.

The buyer could perceive the information provided in an agenda strategy as helpful in several ways. First, the agenda's suggested constraint, which classifies choice options as acceptable and unacceptable, may be considered to be helpful "advice" from the seller. Because the quantity of

verifiable competitive information shared in the agenda strategy is greater than usual for a sales presentation, the shared information may be construed as the seller's attempt to help the buyer find the right solution - evidence of the salesperson's customer orientation. Second, providing the reliability ratings for all copiers remaining under consideration is likely to assist the buyer in differentiating the target product from the competition. Finally, the fact that the seller's product is grouped with the "better" products that surpass the suggested constraint, but is not shown as necessarily "the best" on a specific attribute, may lend the perception of greater credibility concerning that seller. Taken together, buyers may perceive that the characteristics of information exchange in agenda strategies (as opposed to summary-of-benefit strategies) are similar to the norms of information exchange when a buyer-seller relationship exists. Thus, the buyer may perceive a stronger relationship with a seller using an agenda strategy to make the presentation.

In the remainder of this paper we report some exploratory data from a study of organizational buyers that provide some preliminary evidence about whether selling strategies can encourage the development of buyer-seller relationships.

### Methodology

*Sample.* The data for the current analysis comes from a study more fully described in Wagner, Klein and Keith (2001). Participants were buyers who had been identified as having primary responsibility for purchasing a copier for their organization; these organizations had previously been identified as likely users of a mid-sized copier, the product in our study. Buyers who agreed to participate were sent a computer-interactive survey ([Sawtooth Software](#), 1991), which 128 of them (62 percent of those who had agreed to participate) finished and returned.

*Overview of Procedures.* We mailed buyers an envelope containing the diskette for the simulated sales calls in the form of an interactive survey and instructions. In addition, we included a product-by-feature chart of basic features for twelve copiers, which constituted the choice set. The



information on this chart allowed buyers to form initial assessments prior to sales calls and helped with later decisions about additional sales calls. During the computer-interactive survey, each buyer received two unsolicited sales calls. One was on behalf of a target product whose competitive position and selling strategy were manipulated; the second sales call was from a salesperson representing the market leader and was used to disguise our focus on the target product. The order of these two sales calls was varied across participants. After their completion, buyers could request as many additional sales calls as they wished from salespeople representing the remaining ten copiers described on the product-by-feature chart. All sales calls were simulated and involved written text only.

Each sales presentation was designed to encourage a positive evaluation of the product by presenting favorable information on reliability, productivity, service turnaround, and price. Presentation content was kept as similar as possible while trying to highlight the advantages of each product, with the exception that the agenda strategy described earlier included the additional competitive comparisons and suggestions inherent in the agenda being proposed. The remaining parts of the interactive survey incorporated as many elements of a typical copier purchase as possible. In addition to the sales calls, buyers could ask for product demonstrations and get those results, and also ask for specific product information both during and after the sales calls. After all of these elements had been completed, buyers made a purchase decision. We then asked them to indicate with which salesperson, if any, they felt the strongest relationship.

*Manipulations and Measures.* Our experiment had a 2 (target product selling strategy) x 2 (target product competitive position) between-subjects design. The target product was sold using either a summary-of-benefits or an agenda selling strategy, as described earlier. All other presentations, such as those for the market leader and other competitor products, used a summary-of-benefits approach that focused on the strengths of the product being presented.

For all of the sales calls in this simulation, buyers were told that they had purchased from the vendor companies in the past but that it hadn't been important to maintain an on-going relationship with any of them. It was further stated that all sellers had knowledge of the buyer's current needs from previous interactions. Thus, the initial buyer-seller relationship was the same for all vendors. Any distinctions made among the salespeople in response to this question should be attributable to the interactions that had taken place during sales calls and the buyers' consequent perceptions of the sellers involved.

We experimentally manipulated the target product's *relative competitive position* by changing which product in the choice set, in addition to the market leader, made the initial sales call. The two target products were Copier G, which we label as a Strong Contender, and Copier K, which we label an Average Performer. The Strong Contender (G) had one very strong attribute (reliability), slightly better than average productivity and service turnaround, and slightly above-average price. Copier K, the average performer, was very strong on one attribute, productivity, but had a significant weakness on service turnaround, slightly below average reliability, and correspondingly, a lower than average price. In addition to these two target products, buyers received an unsolicited sales call from the Market Leader, (Copier H). This Market Leader was very strong on both productivity and service, had average reliability, and a higher than average price. Pretests participants ranked these three copiers in an order consistent with our intended manipulation of competitive position, with mean ranks of 2.9 for the Market Leader H, 5.5 for the Strong Contender G, and 6.5 for the Average Performer K.

The dependent variable was the response to a question that we asked after the buyer had received both the prearranged and requested sales calls and had chosen a product. In the midst of several questions about the decision process they had used and the importance of different attributes, we asked the buyer with which seller, if any, the buyer had felt the strongest relationship. The buyer

could choose from a list that included each of the twelve products along with an option stating that the relationships with all sellers were about the same.

## Results

Table 1 shows the frequency with which buyers identified a salesperson as being the representative with whom they felt the strongest relationship. The first column gives the designation for the product presented in the sales call. In the simulation, all buyers received an unsolicited sales call from the Market Leader product (H) and two other products (G and K). In addition, they were free to request sales calls from the salespeople for nine other products, and 55 percent of the sample did request a sales call from at least one of those salespeople. Because of the relatively small number of sales calls requested for each individual option, we group these requested sales calls into one category for the purpose of these analyses.

A  $\chi^2$  goodness of fit test shows a significant pattern in buyers' choice of the salesperson with whom they felt the strongest relationship ( $\chi^2 = 16.6, p=.002$ ). Buyers were more likely to report having the strongest relationship with the Market Leader (H = 30.5%) or the Strong Contender (G = 26.6%) salesperson, and less likely to do so for the seller of the Me-Too product (K= 15.6%) or a seller within the group of requested sales calls (11.7%). In addition, only 15.6% reported feeling an equally strong relationship with all of the salespeople. Thus, buyers were generally able to distinguish differences in their reactions toward various salespeople across the simulated sales calls that they received.

If the strength of the buyer-seller relationship is one influence on the success of a sales call, then it is likely that reports of a strong relationship are related to the product chosen by these buyers. Excluding those who had reported an equal relationship with all salespeople, we tested the association between the product choice made by the buyers and the salesperson with which the buyer had reported

the strongest relationship. The results in Table 2 show the nature of the significant relationship ( $X_9^2 = 56.3, p < .001$ ), which is that the majority of buyers (55.6%) reported the strongest relationship with the seller whose product they chose. However, the question of causality remains an important one. It is unclear from these data whether this association occurs because buyers tend to look more favorably on a seller whose product best satisfied their needs or because a salesperson who develops a better relationship during a sales call has a greater chance of success.

In the current research, we had varied the critical factor of selling strategy for the sales calls involving two target products, Strong Contender G and Average Performer K. We therefore compare buyers' identification of their strongest relationship for the occasions when the salespeople for these two products used a summary-of-benefits strategy versus an agenda strategy. For each target product (G and K) whose selling strategy had varied, we tested the relationship between the selling strategy used and the proportion of buyers who stated that their strongest relationship was with that target product. Table 3, Part A, shows the results for each target product. When the target product that we labeled the Strong Contender (G) was presented using a summary-of-benefits strategy, 36.1 percent of buyers reported having the strongest relationship with that seller. This proportion increased to 56.3 percent when its seller used an agenda strategy; however, this increase was not significant using a one-sided  $X^2$  test of independence ( $X_1^2 = 2.77, p = .114$ .) When the target product was the Me-Too product (K), the proportion reporting the strongest relationship with its seller was 16.7 percent when the salesperson used a summary-of-benefits strategy, but 50.0 percent when he used an agenda strategy ( $X_1^2 = 7.70, p = .006$ .) Thus, for the target product that had a weaker competitive position, the selling strategy had a significant impact on buyers' feelings of relationship with the seller, while for the stronger product these findings were in the same direction but not statistically significant.

The analyses thus far have shown that: 1) although buyers began this purchasing simulation with product information for all twelve copiers and equivalent relationships with all sellers, they tended after making a choice to report a stronger relationship to one of the salespeople making a call, 2) reports of having the strongest relationship with the seller of a product are positively associated with the choice of that product, and 3) buyers more often identified the salesperson for one of the two target products as having the strongest relationship when that salesperson used an agenda selling strategy, as opposed to a summary-of-benefits strategy. This pattern of findings leaves open the possibility buyers are simply inferring that their strongest relationship must be with the salesperson whose product they chose; thus, the agenda strategy appears to create a stronger relationship with the seller because it is more successful in getting buyers to choose the product. To test this possibility, we next examine whether there is a relationship benefit gained by the salespeople using an agenda strategy even if that strategy does not lead to choice of their product. That is, can this selling strategy create an ongoing benefit even if the buyer does not purchase during that buying occasion?

To examine this issue, we divided buyers into two groups: those who did purchase the target product (Strong Contender G or Average Performer K) and those who did not. To increase the power of the test, we did the analyses across both target products, as shown in Part B of Table 3. A one-sided  $\chi^2$  test of independence for those who did choose the target product shows no significant relationship between the selling strategy used and whether or not they reported feeling the strongest relationship with the target product ( $\chi_1^2 = .62, p=.329$ .) Across both target products, 60 percent of those who received a summary-of-benefits presentation and 72 percent of those who received an agenda sales presentation indicated that their strongest relationship was with the seller of the target product, which they had chosen. Thus for this group it is unclear whether the agenda selling strategy had an effect on the buyer-seller relationship apart from its success in gaining the sale.

The picture is very different for those who did not buy the target product. For those buyers, only 17.6 percent of those who received a summary-of-benefits presentation believed that their strongest relationship was with the target product salesperson. However, this proportion increases to 40.5 percent for those who had received the agenda strategy presentation ( $X_1^2 = 5.67, p=.017$ ). This finding indicates that even in cases for which the selling strategy does not result in a successful sale, buyers are significantly more likely to report a stronger relationship when the seller has used an agenda strategy as opposed to the more traditional summary-of-benefits strategy.

### Discussion

In total, these findings suggest that selling strategies do have real potential to foster a relationship between the buyer and seller. The buyers in our study were more likely to say that they felt the strongest relationship with the seller of one of our target products when that target product was sold using an agenda selling strategy. This beneficial outcome appears to occur not only when the agenda strategy has a successful sales outcome, but also when the buyer has chosen a different product. Thus, there may be a long term benefit of relationship development that is associated with using an agenda strategy even when the immediate sale is lost.

These findings are preliminary and additional research should explore what aspects of the agenda strategy are instrumental in obtaining this effect. Theoretically, we had argued that the basis for an agenda strategy's ability to foster buyer-seller relationships was its congruence with the relational norm of information sharing, which is inherent in the agenda strategy. This transfer of information provides value to the buyer and also may create a positive impression about the helpfulness and market orientation of the seller. In addition, using the agenda may facilitate the buyer's decision making and increase confidence in their choice, increasing good will toward the seller even in cases where his or her

product is not chosen. Further examination of the buyers' perceptions of both the salesperson and the choice following different selling strategies may yield more information about the nature of this relationship building processes.

**Table 1. Buyer Identification of Strongest Relationship**

<b>Strongest Relationship for Seller of Product ...</b>	<b>Sales Call Role in Simulation</b>	<b>Percentage of buyers who received this sales call</b>	<b>Percentage stating strongest relationship with this seller N=128</b>
H (Market Leader)	Prearranged	100%	30.5
G (Strong Contender)	Prearranged	100%	26.6
K (Me-Too Product)	Prearranged	100%	15.6
P	Requested	29%	6.3
V	Requested	30%	4.7
L	Requested	9%	.8
J	Requested	5%	0
R	Requested	4%	0
N	Requested	3%	0
Y	Requested	3%	0
T	Requested	2%	0
W	Requested	2%	0
Relationships same for all sellers			15.6
			100.0



**Table 2. Relationship between Choice and Perceived Strongest Relationship<sup>1</sup>**

Strongest Relationship	Choice				
	H (Market Leader)	G (Strong Contender)	K (Me-Too Product)	All Other Products	Total <sup>2</sup>
	N=43	N=31	N=10	N=24	N=108
H (Market Leader)	<b>58.1%</b>	19.4%	20.0%	25.0%	36.1%
G (Strong Contender)	14.0%	<b>71.0%</b>	10.0%	20.8%	31.5%
K (Me-Too Product)	18.6%	6.5%	<b>60.0%</b>	16.7%	18.5%
(All Other Products)	9.3%	3.2%	10.0%	<b>37.5%</b>	13.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

<sup>1</sup> ( $\chi^2 = 56.3, p < .001$ )

<sup>2</sup> Excludes the 15.6 percent of the sample who reported feeling the same relationship with all salespeople

**Table 3. Effect of Selling Strategy on Choice of Strongest Relationship**

Selling Strategy for Target Product	A.Target Product		B. Buyer's Choice		Total
	G (Strong Contender)	K (Me-Too)	Target Product	Other Product	
		N=68	N=60	N=40	N=88
<b>Summary-of-Benefits (n=66)</b>	36.1%	16.7%	60.0%	17.6%	27.3%
<b>Agenda (n=62)</b>	56.3%	50.0%	72.0%	40.5%	53.2%
$\chi_1^2$	2.77	7.50	.62	5.67	8.98
<b>p-value<sup>1</sup></b>	.048	.003	.329	.009	.002

<sup>1</sup> Given our prediction that agenda selling strategies will strengthen buyer-seller relationships, all p-values reported here are for 1-sided tests.

<sup>2</sup> Because one cell has an expected frequency of 4.80, this p-value is for Fisher's Exact Test.

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## **AN ATTITUDE BEHAVIOR INVESTIGATION OF CONSUMER PARTICIPATION IN THE ARTS**

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### **ABSTRACT**

Non-profit arts organizations face severe financial pressures in their efforts to provide important cultural benefits. It is vitally important to arts organizations to engage in strategic marketing planning to sustain and increase consumer participation in the arts. This research draws on attitude theory to empirically examine the relationship between consumer participation in the arts and select demographic and attitudinal variables using a sample of arts participants. The results indicate that educational attainment is positively related to arts participation and that participation in the arts is positively related to attitudes toward the arts. Managerial and research implications of the results are discussed.

## INTRODUCTION

The arts provide unique benefits to local, statewide and national culture. Intrinsically, benefits of the arts enhance the quality of life (not only peoples' wealth and employment, but also their environment, physical and mental health, education, recreation and leisure time, and sense of social belonging (*Dictionary of Human Geography, 5th ed.*, 2009)) of those in the community via their inspirational qualities, as well as their ability to provoke thought and to provide social interconnectedness. The arts can also have a tremendous economic impact on a community (e.g., Stoddard, Davé, Evans and Clopton 2006). A recent study published by Americans for the Arts (2007) reported that the nonprofit arts and crafts industry in the United States generated \$166.2 billion in economic activity, greater than the gross domestic product of most countries. According to the study, spending in the arts industry supports 5.7 million full-time jobs as well as nearly \$30 billion in local, state and federal government revenue.

Unfortunately, nonprofit arts organizations are now, more than ever, facing severe financial pressure as the economy remains in recession. During recessionary periods, public financing of arts activities declines along with consumer discretionary spending resulting in a "perfect storm" for nonprofit arts organizations (e.g., Ellis 2009). In light of these factors it is especially important for arts organizations to engage in strategic marketing planning in order to encourage participation of those consumers who constitute their target populations (McCarthy and Jinnett 2001). This paper explores the relationship between consumer participation in the arts and their demographic and psychographic variables with the objective of providing direction for the development of arts organizations' marketing strategies.

### Arts Participation

The conceptual approaches to explain arts participation behavior have lagged behind the empirical studies looking at arts participation trends. For example, a recent (2008) study by the National Endowment for the Arts found that the number of adults in the U.S. attending arts events between 2002 and 2008 has declined for every art form except musical plays. That study then presented its observations about the relationships between consumers' educational attainment and arts participation. A key flaw in this and similar studies is the lack of explanation regarding the mechanisms driving such relationships (e.g., education attainment level and arts participation). Therefore, this paper will begin with some conceptual ideas concerning arts participation and empirically test these notions using a sample of arts patrons.

In a Rand paper, McCarthy, Ondaatje and Zakaras (2001) provided a framework of art participation. Their framework suggested that arts participation can be thought of as a two dimensional concept including "modes of art participation" and "frequency of arts participation." With respect to modes of arts participation, consumers can participate by *attending an arts event* (e.g., attending live events), or *through the media* (e.g., watching arts on television), or by participating in *the creation of art* (e.g., working with clay). Frequency of participation is more straightforward where art consumers might participate rarely, occasionally or frequently (McCarthy, Ondaatje and Zakaras 2001). Therefore, research exploring consumer participation in the arts needs to be clear about which aspects of arts participation is being referred to.

Consistent with much previous work in the area, this paper defines arts participation in terms of frequency of arts participation.

### **Frequency of Consumer Participation in the Arts**

Research exploring consumer participation in the arts has demonstrated correlations between demographic factors and arts participation. For example, Schuster and Davidson (1991) found that as consumer income and educational attainment rises so do art participation rates, while participation across age was relatively constant and women participated slightly more than men (probably due to demographic reasons). However, since there exists a high correlation between education and income, many researchers believe that the educational attainment variable is the predominant explanatory variable for arts participation (e.g., Robinson 1994).

*Educational Attainment and Attitude Toward the Arts.* Several studies have found a link between educational attainment and subsequent arts participation (e.g., Orend 1988). The operational variable seems to be *experience* with the arts. Apparently, higher familiarity and knowledge about the arts acquired from higher educational attainment and concurrent arts experience increases arts participation (Kelley and Freisinger 2000). From the consumer behavior literature Alba and Hutchinson (1987) pointed out that increased consumer familiarity (in this case, more arts-related experiences) generally leads to increased expertise. In turn, increased expertise allows (arts) consumers to have more refined cognitive structures for the arts allowing for a more thorough understanding of the differences within and between various types of arts, as well as enabling the arts consumer to more fully appreciate their arts-related experiences (e.g., have a more positive attitude toward the arts). Therefore:

H1: Increased educational attainment should be positively related to consumer attitude toward the arts.

*Attitude Toward the Arts and Arts Participation.* Much research has demonstrated the relationship between attitudes and behaviors. In fact, Petty and Cacioppo (1981) have written an entire book on this subject. Again, one important factor that they identify linking attitudes and behavior is *experience* with the attitude-object. Increased experience makes more information available about the attitude-object either making the experience more memorable than other experiences, or making the attitude more accessible resulting in more influence over a person's behavior. Fazio and Zanna (1978) found higher attitude-behavior correlations with more experience in a study of subjects' willingness to participate in psychological research projects on the basis of their attitudes toward psychology experiments.

A more recent theoretical explanation linking attitudes and behavior is referred to as "emotional contagion" (Hatfield, Cacioppo and Rapson 1992). Emotional contagion is defined as:

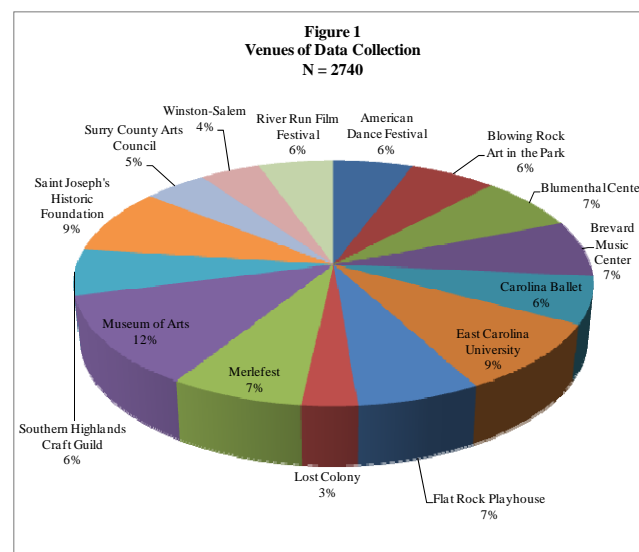
"the tendency to 'catch' (experience/express) another person's emotions (his or her emotional appraisals, subjective feelings, expressions, patterned physiological processes, action tendencies, and instrumental behaviors)" (Hatfield, Cacioppo and Rapson 1992, p. 153).

Essentially then, the premise behind emotional contagion is that previous contact between individuals can result in a transfer of emotions and attitudes from one person to another (Stock and Hoyer 2005). Presumably, arts patrons have a more positive attitude toward the arts than non-patrons, so past participation in arts events would allow contact between individuals that have a more positive attitude towards arts events. If emotional contagion prevails, then increased participation in the arts should result in more favorable attitudes toward arts events.

H2: Increased arts participation is positively related to attitude toward the arts.

## METHOD

*Sample.* The data used to test the hypotheses were collected from fifteen arts venues across the state of North Carolina including art museums, performing arts events, art and craft festivals, film festivals, music festivals, and outdoor dramas. Figure 1 shows the venues of data collection along with the proportion of sample surveys collected at each venue.



The data were collected using a purposeful sampling technique over a one year period from the beginning of July to the end of June. In all, 2,740 usable surveys were collected.

*Measures.* The three variables examined in this study included educational attainment, attitudes toward the arts event and number of times the respondent had attended the arts event in the past (a measure of arts participation). Educational attainment was measured using an ordinal categorical scale including High School, Some College, Associate Degree, Bachelor's Degree, Some Graduate School, and Graduate Degree. Attitude toward the arts event was measured using a nominal categorical scale where respondents were asked to check all categories that applied as follows. Respondents were asked the way they felt about the arts event, the categories included fun, thought-provoking, comforting, nostalgic, educational, good for the family, boring, stuffy, outrageous, relaxing, stimulating and energizing. Finally, the number of times the respondent attended the arts event in the past was a ratio scaled variable. Respondent's attitude



towards the arts event and the number of times respondents attended the arts event were event-specific questions.

## RESULTS

*Hypothesis 1.* The first hypothesis proposed that increased educational attainment would be positively related to attitude toward the arts. A chi-square goodness-of-fit test was employed to test this hypothesis. The expected frequencies used in the chi-square calculation were computed from the proportion of respondents in the sample in each educational category. They were: High School = 9%; Some College = 17.1%; Associates Degree 5.8%; Bachelor's Degree = 23.5%; Some Graduate School = 6.3% and Graduate Degree = 38.2%.

Table 1 shows the results of the analysis. As Table 1 shows, a relationship between educational attainment was found for five of the attitudinal variables. As educational attainment increased, a higher frequency of respondents reported that the arts event was thought-provoking, nostalgic, educational, and stimulating. In addition, as educational attainment decreased, a larger frequency of respondents reported that the arts event was outrageous.

*Hypothesis 2.* The arts participation - attitude hypotheses were tested using a chi square goodness-of-fit test. The expected frequencies associated with the null hypothesis were the actual proportions of previous attendees and non-attendees in the overall sample. Therefore, the actual attitude frequencies were compared using the sample proportions 66.6% (attended the arts event before) and 32.4% (did not attend the arts event before). Then, respondents who indicated that they had attended a particular arts event before were contrasted with those who indicated they had not attended the arts event before on attitude toward the arts event. The expectation was that there would be a higher frequency of people that previously attended the arts event reporting positive feelings about the event than those who had not attended the event previously.

The results are presented in Table 2. As Table 2 shows, a larger frequency of respondents that had previously attended the arts event indicated that the event was fun, comforting, nostalgic, good for the family (marginal), stimulating and energizing than those who had not attended the event before. However, there was no difference between the two groups when asked whether they felt the event was thought-provoking, educational, or relaxing. In addition, there was no difference in the number of respondents that reported the event was boring, stuffy or outrageous whether or not they had previously attended the event. Of the nine positive attitude measures, six were statistically significant between the two groups. Therefore, there appears to be support for the contention that previous arts participation is related to positive attitude toward the arts.

**TABLE 1**  
**EDUCATIONAL ATTAINMENT - ATTITUDE HYPOTHESIS TESTS**

<b>Attitude Measure</b>	<b>Educational Attainment</b>	<b>Observed Frequency</b>	<b>Chi Square</b>	<b>P Value</b>
Fun	High School	147	2.053	.842
	Some College	309		
	Associate's Degree	102		
	Bachelor's Degree	404		
	Some Graduate	120		
	Graduate Degree	663		
Thought-Provoking	High School	37	23.428	.000
	Some College	115		
	Associate's Degree	35		
	Bachelor's Degree	189		
	Some Graduate	49		
	Graduate Degree	327		
Comforting	High School	14	7.678	.175
	Some College	56		
	Associate's Degree	21		
	Bachelor's Degree	67		
	Some Graduate	20		
	Graduate Degree	111		
Nostalgic	High School	11	23.043	.000
	Some College	56		
	Associate's Degree	22		
	Bachelor's Degree	93		
	Some Graduate	33		
	Graduate Degree	164		
Educational	High School	47	11.431	.043
	Some College	140		
	Associate's Degree	40		
	Bachelor's Degree	166		
	Some Graduate	40		
	Graduate Degree	311		
Good for the Family	High School	53	2.229	.817
	Some College	97		
	Associate's Degree	41		
	Bachelor's Degree	145		
	Some Graduate	43		
	Graduate Degree	226		
Boring	High School	6	3.861	.570
	Some College	9		
	Associate's Degree	2		
	Bachelor's Degree	8		
	Some Graduate	1		
	Graduate Degree	13		
Stuffy	High School	3	4.844	.184
	Some College	5		
	Associate's Degree	0		
	Bachelor's Degree	6		
	Some Graduate	0		
	Graduate Degree	3		
Outrageous	High School	14	13.475	.019
	Some College	15		
	Associate's Degree	10		
	Bachelor's Degree	14		
	Some Graduate	2		
	Graduate Degree	35		
Relaxing	High School	58	2.340	.800
	Some College	132		
	Associate's Degree	48		
	Bachelor's Degree	181		
	Some Graduate	50		
	Graduate Degree	302		
Stimulating	High School	54	38.738	.000
	Some College	172		
	Associate's Degree	59		
	Bachelor's Degree	259		
	Some Graduate	76		
	Graduate Degree	506		
Energizing	High School	48	8.291	.141
	Some College	132		
	Associate's Degree	47		
	Bachelor's Degree	180		
	Some Graduate	45		
	Graduate Degree	314		

**TABLE 2**  
**ARTS PARTICIPATION - ATTITUDE HYPOTHESIS TESTS**

<b>Attitude Measure</b>	<b>Attended Before</b>	<b>Observed Frequency</b>	<b>Chi Square</b>	<b>P Value</b>
Fun	Yes	1365	20.55	.000
	No	512		
Thought-Provoking	Yes	571	1.657	.198
	No	245		
Comforting	Yes	234	5.943	.015
	No	81		
Nostalgic	Yes	319	19.907	.000
	No	89		
Educational	Yes	568	2.336	.126
	No	239		
Good for the Family	Yes	473	3.234	.072
	No	192		
Boring	Yes	25	0.529	.467
	No	15		
Stuffy	Yes	9	2.636	.104
	No	9		
Outrageous	Yes	72	0.540	.462
	No	29		
Relaxing	Yes	579	2.323	.127
	No	244		
Stimulating	Yes	890	21.40	.000
	No	311		
Energizing	Yes	609	16.234	.000
	No	209		

## DISCUSSION

The first hypothesis proposed that educational attainment would be related to attitudes toward an arts event. This hypothesis was supported for five of the attitude measures. It seems that increased experience and familiarity with the arts resulting from higher educational attainment can lead to increased expertise, which allows arts consumers to have more refined cognitive structures for the arts enabling the arts consumer to more fully appreciate their arts-related experiences. Of particular importance is the negative relationship between educational attainment and the outrageous attitude measure. Here, a higher than expected frequency of respondents with a lower level of educational attainment reported that the arts event was outrageous.

The second hypothesis was that consumer attitude toward the arts event would be positively related to arts participation. This hypothesis was supported for five of the hypotheses and marginally supported by one. Perhaps positive emotional contagion resulting from past

experience at arts events resulted in more memorable and accessible information and influenced respondents' arts participation.

Two of the attitudinal variables, nostalgia and stimulation, were linked to both educational attainment and arts participation. These links suggest an educational attainment-arts attitude-arts participation relationship. The analytics presented herein preclude cause and effect statements about these relationships, but this area might prove to be a fruitful avenue for future research.

### **MANAGERIAL IMPLICATIONS**

The relationship between educational attainment, attitudes and consumer behavior has been recognized as being important for some time. Plummer (1974) couched these relationships within the term 'life style' and proposed that classifying customers by lifestyle would prove to be more fruitful than by simple demographics alone. He further suggested a life style segmentation approach where product usage and product attitudes are linked. This research has demonstrated this linkage within the context of arts participation and attitude toward the arts event. In the present case the findings suggest that art patrons who felt that the arts event was fun, comforting, nostalgic, good for the family, stimulating and energizing appear to attend the arts event more frequently.

The present research has implications for an arts organization's marketing strategy (i.e., defining target markets and developing marketing mixes). With respect to defining key markets this research suggests that not only are arts patrons more highly educated, but they are also people who attend arts events for hedonic reasons. Therefore, with respect to art product positioning, attitudinal information can be used to supplement other information such as product descriptions (e.g., a comedic play that is both stimulating and energizing or a dramatic play that is comforting and nostalgic).

Marketing communications can employ attitudinal information in the formation of creative messages such as the types of advertising themes to pursue, or to adjust the tone of the message to match the outcome which the art patron is seeking from participating in an arts event (e.g., art in the park is fun and good for the family). Finally, from a new product development perspective, knowledge that arts consumers attend arts events more frequently when they are seen to be fun, comforting, nostalgic, good for the family, stimulating or energizing suggests that arts organizations look at their current art product offerings to see how well they are meeting the needs of their art patrons. Art patron attitudinal information can assist an arts organization in choosing between several alternative offerings to more closely satisfy the hedonic needs of the arts consumer.

### **CONCLUSION AND FUTURE RESEARCH**

Previous research has found that art patrons tend to have higher educational attainment than the general population. This research supports that contention and suggests that higher educational attainment leads to increased consumer familiarity with the arts allowing for a more thorough understanding of the differences within and between various types of arts, as well as enabling the

arts consumer to more fully appreciate their arts-related experiences. Furthermore, increased patron experience with the arts may make more information available about the arts in long term memory. In turn, increased availability of arts-related information might result in the art experience being more memorable than other experiences, or make the art experience more accessible than other leisure experiences resulting in more influence over a person's behavior. Finally, emotional contagion resulting from increased exposure to the arts may result in more positive attitudes toward the arts.

Holbrook and Schindler (1996) have conducted some interesting research linking arts participation and attitude toward the arts specifically with respect to nostalgia. They report that the effect of nostalgia on product preferences (such as the arts) is nonlinear and is related to age. Their research demonstrated an inverted U-shaped curve between the effect of nostalgia on arts preferences, where the largest effect of nostalgia occurred when the consumer was first exposed to an arts-related product about the age of 24 years old. More research needs to be conducted to determine whether the other attitudinal variables in this research also exhibit nonlinear relationships with age.

Other life style variables also need to be incorporated into a complete life style analysis. While the present research examined attitudinal variables, added variables such as other art patron activities (sporting events, shopping, entertainment, etc.) and interests (Recreation, community, family, etc.) need to be examined to obtain a well-rounded multi-dimensional view of art patron customers.

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A comparison of inward and outward foreign direct investment  
determinants in Turkey

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## **A comparison of inward and outward foreign direct investment determinants in Turkey**

### **Abstract**

This study compares the outward foreign direct investments (FDI) in Turkey taking into account factors such as the location selection for outward FDI, the stimulus determinant of outward FDI and types of outward Based on the size of inwards FDI, five of the factors affecting location selection are as follows: Market size, whether or not profits can be repatriated, the growth rate of the host country economy, government policy towards FDI and the availability of qualified local labor force. However, the factors of outward FDI are as follows: The advantages of a “first move”, the growth rate of the Turkish economy, the level of industrial competition, market size, availability of low cost inputs and access to neighboring markets. The same differences can be observed for acquisitions –whether Greenfield or joint venture-wholly owned subsidiaries. The study discusses the differences between the firms in developed countries and those in developing countries according to their FDI.

## 1. INTRODUCTION

The results of a study by Tatođlu and Glaister (2000) based on a questionnaire conducted on 98 firms from 13 developed countries about FDI are similar to the findings of the research conducted by the İstanbul Trade Chamber in terms of effects of location selection on investment decisions (Erdilek, 1982, Coşkun, 2001). The results of the study by Tatođlu and Glaister (2000) and the study by Marmara University Scientific Research Commission (Anil et al., 2007) are similar. Since the reasons for the inwards FDI of firms in developed countries and the outwards FDI of Turkish firms to developing countries are common in both studies and they encompass the same period until 1998, both studies are compared to each other and are analyzed in the light of the present study.

Anil et al., (2007) focused on outward FDI investments of Turkish firms towards seven countries of the former USSR between 1989 and 2005. The reliable records of outward FDI cannot be obtained by the Turkish Treasury because of the existence of the shadow economy. Turkey has no investments in developed countries except opening bank branches that are called “finance investments”. The direct capital investment of Turkey is negligible except for investments made in the former Soviet Union countries. These countries can be grouped into three categories: Turkic Rrepublics in Central Asia, Balkan countries, the Russian Federation and neighboring countries. The three homogenous country groups are designated as follows: Turkmenistan, Uzbekistan, Kirghizstan and Kazakhstan for Turkic Republics in Central Asia, Bulgaria and Romania for Balkan countries and the Russian Federation itself and its neighboring countries.

90% of the firms which were ranked by trade attachés (affiliated to consulates) and business associations were interviewed and a questionnaire was administered. The same questionnaire form used by Tatoğlu and Gleister was used for data collection. Thus, it was possible to compare factors measured with the same scale.

## **2. LITERATURE REVIEW**

Firms have to decide the following after a foreign investment decision: the selection of a country for investment, Greenfield or acquisition and wholly owned subsidiaries or joint ventures. (Hennart and Park, 1993). Analysis of factors in location selection in the light of meta analysis in Chakrabarti (2001) reveals that market size and growth rate of an economy are the most important indicators in the two investment types. Low labor cost is excluded from these factors because of low productivity and since the deregulation application following neoliberalism is not a determinant of unionization.

Although there are many studies concerning ‘Greenfield or acquisition decisions, that is how many shares of a firm will be shared with others for investment, there is no well-developed theory about the determinant factors of the above-mentioned selections (Barkema and Vermeulen, 1998). Some studies provide certain evidence for using institutional, cultural and transaction cost variables in predicting acquisition and Greenfield start-ups in international growth. The results obtained by the authors also suggest that organizations which have certain abstract capabilities can use their capacity with Greenfield start-ups easily. It is suggested that diversification can be easily realized with Greenfield applications in high growth markets.

Two recent efforts used transaction cost theory in explaining how firms make a selection between Greenfield start-ups and acquisitions (Hennart and Park, 1993). However, Robins

(1987) and Kogut and Singh (1988) suggest that the explanations for selections "...should be evaluated with factors stemming from the institutional and cultural contexts" (Kogut and Singh, 1988: 412). The researchers imply that institutional/cultural contexts and transaction costs should be examined simultaneously in order to understand the diversification selection (selection between Greenfield start-ups or acquisitions) of firms.

Studies on the detection of variables of preferences in investment decisions argue that the service sectors and production sectors can act differently because of the differences in risk dimensions and trust need in terms of the transition cost economy (Brouthers and Brouthers, 2003). While the peripheral uncertainties and risk dimensions of production investments affect the selection of firms, behavioral uncertainties, trust tendency and asset specificity affect the selections of the service providers because of the labor intensive nature of the service (Delios and Beamish, 1999; Erramilli and Rao, 1993; Gatignon and Anderson, 1988). Some studies argue that firms tend to interiorize the transactions while the specificity of assets is increasing and joint venture is preferred while the specificity of assets is decreasing (Delios and Beamish, 1999; Gatignon and Anderson, 1988).

There are two different opinions about the effect of peripheral uncertainty and selection type. Firstly, Williamson (1991) argues that joint venture is used less in high peripheral uncertainties because harmony between parties cannot be provided immediately. Furthermore, Williamson and Hennart (1988) suggest that fully owned firms provide harmony immediately through authorization. However, many researchers, (Gatignon and Anderson, 1988; Kim and Hwang, 1992) argue that joint venture is beneficial for accelerating harmony because of its flexibility in conditions of high uncertainty. Defenders of transition costs, despite all these

arguments, argue that the wholly owned subsidiary is preferable in order to achieve control over firms and to lower the transaction costs in conditions of high uncertainty (Chiles and McMackin, 1996). Some studies on the selections of manufacturing companies state that manufacturing companies prefer joint ventures when there are high uncertainties in the host country in order to reduce the financial burdens on them. The findings are compatible with the study by Gatignon and Anderson (1988) that examines the entry of American manufacturing companies into foreign markets and concludes that manufacturing companies prefer joint ventures in high risk markets.

Firms entering markets with only a few cultural differences perceive the risk as low and therefore use Greenfield entry, thus maximizing advantages particular to the firm. By contrast, firms entering markets with many cultural differences perceive the risk as high and prefer to use the acquisition method (Chatterjee, 1990; Lie, 1995; Hofstede, 1989; Yip, 1982).

### **3. FINDINGS (THIS SECTION WILL BE EXPANDED,)**

#### **3.1-Findings about location selection**

The value rating of location selection determinants is shown in Table 1. Accordingly, the priority rating of countries investing in Turkey according to a five-level Likert scale is as follows: Market size, whether or not profits can be repatriated, growth rate of the host country economy, Government policy toward FDI and the availability of qualified local labor force. However, the factors of outward FDI according to the same scale are as follows: The advantage of being the first mover, growth rate of the Turkish economy, the level of industrial competition, market size, the availability of low cost inputs and finally the access to neighboring markets. The biggest determinant of Turkish firms for outward FDI is the advantage of being the first mover and this item does not occur in the other scale, therefore it is not used in comparison but the

other six variables are used for comparison. Differences in ordering are compared with a T test both for importance and average. The value of each factors ranked in terms of clarity.

**Table 1: Relative importance of host countries' location influences for FDI from Turkey (Valid N = 104)**

Question	Mean	Std. Deviation
2	3.715	1.3824
17	3.467	1.362
1	3.463	1.5642
12	3.438	1.388
18	3.374	1.7295
16	3.318	1.4446
10	3.313	1.3503
7	3.000	1.6325
13	2.986	1.6683
5	2.710	1.3599
14	2.692	1.7879
9	2.687	1.5729
4	2.673	1.5693
6	2.491	1.2668
11	2.396	1.6017
3	2.336	1.6523
8	2.075	1.6409
15	1.358	0.864

Note: Mean is the average on a scale of 1 (no importance) to 5 (major importance)

Table 1 shows the arithmetic means and standard deviation values of the questions used in the survey. High mean value shows that the relative importance of that variable is also high. Therefore, variables sorted from high to low mean values also correspond to the ordering of variables in terms of relative importance for investment in regard to the countries. The value of question 19 is available below for the same table. The most important variable for investment decision is “the advantage of being the first mover”.

	Mean	Std. Deviation
Question 19	4,743	6881

**Table 2: Factors of host countries' location influences**

Factors	Factor Loads	Eigenvalues	% Variance Explained	Cumulative Per Cent	Cronbach Alpha
<b>Factor 1</b>		4,11	13,81	13,81	,88
Question 4	0.841				
Question 3	0.839				
<b>Factor 2</b>		2.25	11.48	25.29	0.69
Question 13	0.719				
Question 8	0.718				
Question 7	0.622				
<b>Factor 3</b>		1.96	11.14	36.43	0.67
Question 16	0.835				
Question 1	0.801				
Question 2	0.521				
Question 15	0.51				
<b>Factor 4</b>		1.38	11.10	47.54	0.66
Question 12	0.816				
Question 11	0.603				
Question 18	.469				
<b>Factor 5</b>		1.30	10.66	58.20	.50
Question 9	.792				
Question 14	.708				
Question 10	.496				
<b>Factor 6</b>		1.00	8.42	66.62	.53
Question 6	.786				
Question 17	.770				
Question 5	.487				

Note: K-M-O measure of Sampling Adequacy = 0.6620 and Bartlett Test of Sphericity = 610.445 (p<0.000)

### 3.2-Findings about the type of investment

It is seen that convictions about the growth rate of the Turkish economy, the degree of unionization and the purchasing powers of customers affect preferences in regard to Greenfield

or acquisition. That is, there is a significant difference between two groups. The level of significance is 0.95. Accordingly, firms who perceive the growth rate of economy, the degree of unionization and the purchasing power of customers as high prefer the Greenfield investment type.

According to the results of study by Tatoğlu and Glaister (2000) firms investing in Turkey prefer market size and the availability of good quality inputs on a 0.01 significance level and prefer the availability of low cost inputs and access to the neighboring market factor on a 0.05 significance level. Therefore they prefer acquisition investments. Question 19 has the same values with a significance level 0.95, in other words, the possibility of falsity is 0.05.

### **3.3- Findings about type of ownership:**

There is not a significant relation between the preferences about capital structure (type of ownership) and convictions about location selection. Tatoğlu and Glaister (2000) identified the following factors as having significant relations between location selection and type of ownership: The purchasing power of customers, the degree of unionization and international transport and communication costs. The significance level is 0.05. Accordingly, while the value of the factors is low, the ownership preference is JV (Joint venture).



**Table 3: Relative importance of factors by mode of entry**

Question		Mean	Std. Deviation	T value
1	GRF	3.438	1.5750	-0.11
	ACQ	3.475	1.585	
2***	GRF	3.938	1.3095	2.14
	ACQ	3.35	1.4597	
3	GRF	2.315	1.6714	-0.07
	ACQ	2.338	1.6148	
4	GRF	2.6	1.5161	-0.56
	ACQ	2.775	1.6406	
5	GRF	2.8	1.3829	0.73
	ACQ	2.6	1.355	
6	GRF	2.492	1.1742	-0.13
	ACQ	2.525	1.414	
7	GRF	2.977	1.7330	-0.27
	ACQ	3.063	1.4771	
8	GRF	2.138	1.6852	0.42
	ACQ	2	1.6172	
9	GRF	2.877	1.6227	1.73
	ACQ	2.338	1.4384	
10	GRF	3.254	1.4173	-0.44
	ACQ	3.375	1.2545	
11	GRF	2.246	1.6011	-1.1
	ACQ	2.6	1.5981	
12	GRF	3.362	1.4618	-0.72
	ACQ	3.563	1.2669	
13	GRF	3.2	1.7248	1.81
	ACQ	2.613	1.5379	
14	GRF	2.985	1.7897	2.23
	ACQ	2.2	1.6825	
15***	GRF	1.462	1.0470	2
	ACQ	1.175	0.3848	
16***	GRF	3.415	1.4240	0.91
	ACQ	3.15	1.4772	
17	GRF	3.431	1.4358	-0.43
	ACQ	3.55	1.2598	
18	GRF	3.323	1.7687	-0.65
	ACQ	3.55	1.6633	
19	GRF	4.739	0.6358	-0.08
	ACQ	4.75	0.7763	

**Table 3: Relative importance of factors by ownership pattern**

Question		Mean	Std. Deviation	T value
1	WOS	3.433	1.5473	-0.2
	JV	3.5	1.6557	
2	WOS	3.68	1.3770	-0.4
	JV	3.8	1.4479	
3	WOS	2.213	1.6382	-1.09
	JV	2.6	1.6474	
4	WOS	2.64	1.5368	-0.28
	JV	2.733	1.6386	
5	WOS	2.693	1.4329	-0.36
	JV	2.8	1.2149	
6	WOS	2.467	1.2770	-0.49
	JV	2.6	1.2484	
7	WOS	3.053	1.5673	0.43
	JV	2.9	1.8118	
8	WOS	1.987	1.6149	-0.97
	JV	2.333	1.7486	
9	WOS	2.753	1.5298	0.84
	JV	2.467	1.6761	
10	WOS	3.253	1.3136	-0.56
	JV	3.417	1.4627	
11	WOS	2.387	1.5759	0.06
	JV	2.367	1.6914	
12	WOS	3.353	1.3993	-0.99
	JV	3.65	1.3592	
13	WOS	2.993	1.6409	0.17
	JV	2.933	1.7798	
14	WOS	2.733	1.7808	0.43
	JV	2.567	1.8134	
15	WOS	1.413	0.9739	1.49
	JV	1.2	0.4842	
16	WOS	3.373	1.3434	0.6
	JV	3.167	1.6833	
17	WOS	3.653	1.1448	1.79
	JV	3.033	1.7515	
18	WOS	3.347	1.7514	-0.59
	JV	3.567	1.6750	
19	WOS	4.743	0.7325	0.01
	JV	4.742	0.5755	

### 3.4 Findings about cultural familiarity and type of ownership

Share/Rate		Mean	Std. Deviation	T value
Question 12a***	JV	3.129	1.0565	2.58
	WOS	2.56	1.0232	
Question 12b	JV	2.826	1.3022	0.76
	WOS	2.607	1.1333	
Question 12c	JV	2.355	1.2530	1.75
	WOS	1.927	0.833	
Question 12d***	JV	2.21	1.3024	2.38
	WOS	1.627	0.6319	

There is a significant difference between WOS and JV groups about question 12a (similarity level of country cultures) and question 12d (similarity level between countries in terms of working conditions and methods) on 0.05 level. Accordingly, firms that have high levels of perception about the similarity level of country cultures and similarity level between countries in terms of working conditions and methods prefer JV ownership. There is not a significant difference between culture of headquarter (question 12b) and new branches of the firm in foreign countries in terms of similarity of business ethics (question 12c) in the two countries and ownership type.

#### Group Statistics

Share/Rate		N	Mean	Std. Deviation	T value
Question 12***	JV	31	2.5954	1.01978	2.27
	WOS	75	2.1594	0.50640	

There is a significant difference between newly formed 12th group with the mean of four groups for measuring cultural familiarity and ownership type (WOS and JV) at a 0.05 level. JV is preferable in high levels of cultural familiarity.

## 4. CONCLUSIONS

This study compared the outward foreign direct investments (FDI) in Turkey taking into account factors such as the location selection for outward FDI, the stimulus determinant of outward FDI and types of outward FDI, and discussed the differences between the firms in developed countries and those in developing countries according to their FDI. Firms who perceive the growth rate of economy, the degree of unionization and the purchasing power of customers as high prefer the Greenfield investment type, and firms investing in Turkey prefer market size, the availability of good quality inputs, the availability of low cost inputs and access to the neighboring market factor and acquisition investments.

THIS SECTION WILL BE EXPANDED.

THERE WILL BE MORE STATISTICAL ANALYSIS IN THE PREVIOUS SECTIONS.

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**SUSTAINABLE STRATEGIC MANAGEMENT (SSM)  
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**SUSTAINABLE STRATEGIC MANAGEMENT (SSM)  
IN EMERGING ECONOMIES**

**ABSTRACT**

Recent research has challenged the long-term viability of traditional competitive strategies, primarily from environmental and ecological points of view, and has sought to bridge the gap between these ostensibly contradictory perspectives. This paper builds on previous work by considering the notion of sustainable strategic management (SSM) in emerging economies. Effective management of the environmental, economic, and social responsibility issues is critical to the success of any SSM plan. These functional areas are at the core of any society's existence and must be monitored and managed for any sustainability efforts to be successful. Two disparate cases—Chile and Poland—are discussed to illustrate the significance and difficulty of implementing SSM efforts in emerging economies. Implications and directions for future research are presented.



## **Introduction**

Frustration has been mounting over the apparent incompatibility between profit-seeking enterprises in free market economies and the effective management of limited global resources. Research has begun to address both perspectives and pursue greater compatibility—not contradictions—between the two. The sub-discipline of sustainable strategic management (SSM) seeks to fill this gap (Parnell, 2008; Stead & Stead, 2004). Social and ecological problems emerge from the neoclassical principle and belief that the pursuit of individual interests should be tempered with long term societal concerns (Stead et al., 2003).

Sustainability is a question of scale. This appreciation of appropriate scale for measuring sustainability focuses organizational energy and resources on issues and situations such as resource reduction, material reduction, energy efficiency, recyclability, and reusability. Viewing issues and decisions from the appropriate scale perspective can be a challenging task for managers. With intense efforts continually focused on seeking unlimited growth, the issue of scale becomes very important. Incorporating the concept of appropriate scale assists decision makers in implementing policies that maximize economic benefits and minimize environmental concerns (Stead, et al., 2003).

At the national level, a sustainable development strategy is a multi-dimensional process that includes individual residents, local associations, non-governmental organizations (NGOs) , religious institutions, private enterprises, and governmental organizations. Many local governments can facilitate a collaborative preparation process by participating in the development of ideas and directions for implementation of the plans. As a result, a link between the formal governmental sector and the community needs to be established to mediate, coordinate, and monitor the activities that are associated with defining the problems and finding

alternative solutions to remedy these problems (Ciegis & Gineitiene, 2008). This “planning group”—which emerges from the collaboration of all of these entities—provides a link with a broader range of community organizations that can assess challenges, determine resources, allocate time, and implement solutions to sustainability issues (Ciegis & Gineitiene, 2008).

This paper reviews the SSM construct with an emphasis on SSM at the nation level of analysis in emerging economies. The constructs of strategy, performance, and sustainability are addressed. Within this context, the focus shifts to the role of managers and government policy makers as they implement the guiding principles and courses of action that will lead to successful SSM efforts. The complexity and importance of this activity from a global perspective is illustrated by elaborating on two disparate nations, Chile and Poland. Conclusions and opportunities for future research are presented.

## **THE CONSTRUCTS: STRATEGY, PERFORMANCE, AND SUSTAINABILITY**

### *Strategy*

Although treatises on strategic planning date back over two thousand years (e.g., Sun Tzu), the application of strategic practices to modern organizations has occurred more rapidly in developed nations. Three contemporary perspectives on strategy are especially noteworthy and serve as the basis of a useful working definition of the concept. George Steiner’s (1979) emphasizes the link between strategy and mission. Because stakeholders have different perspectives on the purpose of a firm and may have different, conflicting goals for its activity, this nexus can quickly become cumbersome. Hence, top executives should not only be concerned with the shareholders’ primary concern—profit—but also with the concerns of other stakeholders.

Henry Mintzberg's perspective on strategy differs somewhat from that of Steiner. According to Mintzberg (1987), a strategy is a *plan*, a consciously intended course of action to address a situation. It is an ingrained way of perceiving the world that can be seen in a stream of actions. It anchors an organization in its environment. Mintzberg's perspective emphasizes the link between strategy and planning. In contrast to Steiner and Mintzberg, Michael Porter (1996) emphasized uniqueness, the idea that a firm's strategy is what sets it apart from its competitors in its quest for competitive advantage.

Because no single firm can emphasize everything simultaneously, strategy formulation involves choices and trade-offs. Porter's (1985) generic strategy typology illustrates this principle. According to Porter, a business can maximize performance *either* by striving to be the low cost producer in an industry or by differentiating its line of products or services from those of other businesses; either of these two approaches can be accompanied by a *focus* of organizational efforts on a given segment of the market. According to Porter, a business attempting to combine emphases on low costs and differentiation invariably will end up "stuck in the middle" (Porter, 1980, p. 41), a notion that received considerable early support (Dess & Davis, 1984; Hambrick, 1981, 1982; Hawes & Crittendon, 1984) but was later challenged by a number of studies (Buzzell & Gale, 1987; Buzzell & Wiersema, 1981; Hill, 1988; Murray, 1988; Parnell, 1997; Phillips, Chang, & Buzzell, 1983; White, 1986; Wright, 1987). Whereas Porter contends that trade-offs in strategic choice are inevitable, those in the "combination strategy school" have argued that some businesses successfully combine low costs and differentiation by creating resource synergies that overcome any ostensible tradeoffs. Hence, the notion of trade-offs in strategy formulation represents a generally accepted tenet, although the extent to which they are necessary remains widely debated (Parnell, 2006).

Although a number of other sound perspectives on strategy exist, a suitable working definition of the concept can be based on these contributions. Herein, a strategy is defined as top management's unique plan to develop and sustain competitive advantage and superior performance so that the organization's mission is fulfilled. This definition assumes that an organization has a plan, its competitive advantage is understood, and that its leaders understand the reason for its existence, an assumption based on the contributions of Steiner, Mintzberg, and Porter (Hambrick & Fredrickson, 2001).

### *Performance*

Strategies are executed in anticipation of some type of expected outcome, or "performance." Research suggests a link between strategies at various levels and firm performance (Abernethy & Guthrie, 1994; Govindarajan & Gupta, 1985; Ittner, Larcker, & Randel, 2003; Parnell, 2000; Parnell & Wright, 1993). Just as there can be many different expected outcomes—profitability, survival, contribution to the general welfare, and the like—there can be many ways to measure it. This reality creates an interesting conundrum for strategy scholars seeking to evaluate the level of effectiveness associated with various strategies.

Traditionally, firm performance has been measured in three ways. First, financial measures provide objective indicators of a firm's performance. Accounting data such as return on assets (ROA), return on investment (ROI), and return on sales (ROS) have been applied to numerous studies (Bromiley, 1986; Daily et al 2002; Jacobson, 1987; Palepu, 1985). Proponents of using financial measures emphasize the objectivity associated with comparing the performance level of various business units along standardized lines (Siegar, 1992). Financial measures often do not result in the valid valuation of intangible assets, however (Huselid, 1995). Nonetheless, financial measures remain the most popular and widely accepted approach in

strategy-performance studies (Geringer, Beamish & daCosta, 1989). In addition, financial measures are consistent with an emphasis on profits as the predominant desired outcome.

Second, market-based measures of performance have received considerable attention in the literature (Amit & Livnat, 1988). Market value added (MVA) has been touted in the popular press as the most accurate means of evaluating how well a firm creates shareholder wealth (Tully, 1994).

Third, qualitative measures include subjective areas of performance such as ethical behavior, stakeholder satisfaction with performance, customer satisfaction, and management satisfaction with performance (Parnell, Lester, & Menefee, 2000). They may also include employee satisfaction, delivery performance, process improvement, measures of material and parts delivery time, throughput time, due-date performance, quality, machine flexibility, and inventory levels (Hendricks, Defreitas, & Walker, 1996). Viewing performance through a non-financial lens can provide insight into organizational processes and outcomes that cannot be seen via financial measures. In fact, non-financial measures are indicators of intangible assets and key drivers of firm value and may be better predictors of future financial performance than historical accounting measures, and thus should be disclosed (Ittner & Larcker, 1998; Kaplan & Norton, 1996; Wallman, 1995). The recent interest in qualitative, non-financial measures of performance suggests an increase in the importance of concerns beyond the basic profit motive.

As can be seen, measurement of performance is directly linked to the organization's objectives. Financial objectives (e.g., profits, sales growth, etc.) can be readily measured through traditional, quantitative means. In contrast, it is difficult to assess environmental objectives (i.e., those associated with sustainability) with financial measures.

## *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). 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. 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 (Parnell, 2008). *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 vernacular, most studies that address one of these types of sustainability tend to avoid the other type. Some exceptions exist in select topics, however, such as recent work that has evaluated consumer preferences for various corporate environmental stances (Sangle & Babu, 2006, 2007). Building on these two notions of sustainability, SSM has been defined as the strategies and related processes associated with the continuity of superior performance—broadly defined—from both market and environmental perspectives (Parnell, 2008).

Considering the link between the two types of sustainability, one can readily see SSM's distinctiveness. When market sustainability and environmental sustainability are examined simultaneously, however, three broad possibilities emerge, as depicted in figure one. First, a strategy that lacks market sustainability—regardless of its environmental sustainability aspirations—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.

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Insert figure 1 about here  
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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 manages external resources appropriately, neither succumbs to nor invites government regulation, and 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 most 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 expense of environmental sustainability creates a key concern, however, and ultimately leads to a number of vibrant research opportunities.

Blending the notions of market and environmental sustainability has been a topic of increased interest in development nations where the existing infrastructure and a strong resource base enable firms and governments to make long-term investments in economic solutions that meet both objectives. The notion of SSM—at both organizational and national levels—presents challenges for both researchers and practitioners in developed and emerging economies. Where resources are limited, however, efforts aimed at sustainability become more complex in emerging economies because difficult choices must be made between basic economic development and human needs in the short term, and long term sustainability (Stead & Stead, 2004). Specifically, the importance and reality of these sustainable strategic management concepts, constructs and parameters can be illustrated using Chile and Poland as examples of active and ambitious attempts to implement the spirit and substance of these principles.

#### **SSM IN AN EMERGING ECONOMY: THE CASE OF CHILE**

SSM is not an occurrence restricted to a single organization or a single country. It is a management action that is required for all organizations, regardless of their geographical locations. As global markets emerge and develop, organizations have to respond with new and innovative ideas. Contemporary organizations have to learn different methods for focusing on profits while simultaneously addressing social and environmental concerns. Such a sustainable management approach encourages an integrative corporate policy that concentrates on these



issues. This design is known as the triple bottom line (Pflieger, Fischer, Kupfer, & Eyerer 2005). Figure 2 can be viewed as a triangulation model whereby managers must consider the economic aspects, social responsibility, and environmental relationships associated with their strategic management decisions. This figure illustrates the integrative relationships that are established for each dimension.

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Insert Figure 2 about here  
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Strategic sustainability links an organization's continuing ability to guard and grow shareholder value through confidently managing its contacts with relationships and diverse stakeholder constituencies. This involves integrating economic, social, and environmental issues and opportunities with decision-making activities 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). Visible and verifiable stakeholder-driven sustainable business operations are emphasized.

### *Chilean Economics*

Fontaine (1993) and Urzúa and Arenas (2003) reveal that over the last few decades Chile has supported an economic development strategy that incorporated unilateral trade liberalization, implementation of large-scale structural changes to attract foreign capital, and privatization of state owned companies. This joint effort between the Chilean government and business has catalyzed enormous economic growth<sup>1</sup> The Chilean economic principle was developed and put into operation all through the Augusto Pinochet military government (1973-1989), and to this

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<sup>1</sup> Chile has a population of about 15 million people. It is a slim strip of mountainous land extending over more than 30 degrees latitude, and includes an area of 757,000 square kilometers. Because it is situated along a lengthy coastline, the country has significant fish resources. Its mineral resources —copper, salt-petre, iron and zinc— are few but substantial in quantity.

day it has been administered with virtual success by the governments of the Coalition for Democracy Party (1990-2007).<sup>2</sup>

The Chilean Economic Model can be examined by studying the main economic transformations that produced this model. Macroeconomic policies focusing on 1) fiscal discipline, 2) monetary unit, 3) economic opening, 4) redefining the State's role, 5) freedom of the labor market, and 6) the privatization of the social security system all play a part in the strong present day economic foundation that furnishes many Chilean people and businesses great economic opportunities. The transformations are detailed below.

As De Gregorio (2005) points out, until 1974 Chile had an unremitting fiscal deficit. The military regime that came after the coup d'etat in 1973 initiated a demanding program of macroeconomic stabilization and structural adjustment. This program incorporated a strong reduction of the public's consumption (expenditures) and a substantial increase in income tax. The program's main charge was to quickly halt the inflationary spiral (Fontaine, 1993).

As soon as the crisis of the external debt of the 80's was surmounted, fiscal discipline became much more forceful. Financial surpluses materialized during the period of 1987-1998, which generated a substantial decrease in the public debt. By 1989, the total debt of the consolidated public sector (central government) reached, in net terms, 40% of GDP, while in 2003 it was only 7%. Actually, during 2006 the surcharge on Chile's public debt relating to the United States Treasury's never surpassed 70 base points (De Gregorio, 2005).

While the stabilization plan implemented by the military regimen achieved a decrease in the annual inflation rate of three to two digits, the continual decrease of inflation to levels of

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<sup>2</sup> President Augusto Pinochet sought the assistance of Sergio De Castro as a consultant. De Castro was the intellectual leader of the "Chicago boys," a group of university deans and scholars who studied at the University of Chicago. These free-market-oriented thinkers brought new ideas on how Chile should conduct its national business (Spillan, et al., 2008).

developed countries only began in 1990. Historically, the inflation rate frequently exceeded 25% per year. Today, the average inflation rate does not exceed 3% annually.

The Central Bank of Chile has been autonomous since 1989. A constitutional law maintains that the primary objective of the Central Bank of Chile is to achieve the economic stability of prices and maintain routine functioning of the system of payments. Different from other central banks in the world, the Central Bank of Chile avoids issues of economic growth or unemployment. The Central Bank of Chile retains independence in terms of its objectives, its budget, and it is forbidden by law from issuing financial instruments to buy the government of Chile's debt (De Gregorio, 2005).

When democracy arrived to Chile, the Coalition for Democracy Party expanded the aperture of government and the economy. By 1991 the tariff rates had declined unilaterally from 15 to 11 per cent, and they continued to decrease until 2003 when the tariff level had a general valuation of 6 per cent. One of the primary contributions of the Chilean democratic government that led to the creation of the strong economic model was found in its bilateral strategy of an open economy. After the free trade agreements were signed with other global economies, the Chilean economy increased its growth substantially. Presently, Chile has free trade agreements with the United States, the European Union, Japan, China, and Korea (Fontaine, 1993). All of these business relationships substantially enhance the economic well being of Chilean businesses and citizens.

One of the major actions that has significantly increased Chile's economic stability and strength is privatization. Privatization was one of the governments' first goals. According to Larroulet (1984), in 1973 the state companies were producing 85 % of the GDP in the mining sector, 40 % in the manufacturing sector, and 70 % in the transportation and telecommunications

sectors. From 1974 to 1980 Chile began re-privatizing agricultural firms, banks, and industrial companies that were expropriated during the socialistic government of Salvador Allende. The privatization process permitted people to make their own investment choices. Furnishing people an opportunity to create wealth on their own was an important step in development in Chilean economic growth and development (Spillan, et al., 2008).

With privatization came the liberalization of the labor markets, which began in 1979. The principal aims of this policy was to reduce the monopolistic power of the unions and to decrease the governmental intervention in the fixing of wage levels. Other measurements that were included in this reform were the reduction of restrictions for the dismissal of employees and the elimination of barriers to entry into different occupations (DeGregorio, 2005).

Although Chile has created a powerful culture for economic growth, it has also influenced the environmental and social sectors of the Chilean society. Chilean officials now comprehend what industrialized nations have been recognizing for some time: that SSM is now a major issue affecting all future strategic decision making. The next section discusses Chile's SSM performance trends (Spillan, Norcetti, Saens, & Cerda, 2008).

### *Environmental Concerns*

Chile's economic growth has generated environmental problems associated with over-exploitation of important natural resources. Abuses and uncontrolled exploitation have had a negative environmental impact on the Chilean society (Spillan, et al., 2008). Specifically, over-exploitation of native fishing and forest species, atmospheric contamination, water contamination, and contamination of soils have contributed substantially to the negative impact on all aspects of the society. The results of these abuses have caused Chilean citizens to become concerned about the quality of air and water in their local communities. The surfacing of this

concern is extremely important because it has prompted action among citizens and officials so that sustainable development policies will be implemented to improve the quality of Chilean citizens' lives (Spillan, et al., 2008).

Air pollution is a key concern in Chile. The important environmental issue of atmospheric contamination is related to such things as smelting particulates and arsenic discharges. All of these pollutants are associated with the mining of copper. Another group of air pollutants arise from refinement of oil, generation of electricity using fossil fuels, production of cement, steel and sugar, and the manufacture of cellulose. The Metropolitan Region (Metro-Santiago) air quality of is a major problem. It is worsened by the high concentration of the population which prevents proper ventilation. Chile is confronted with major health issues as a consequence of air pollution, especially in the Metro region. This geographic area of the country accounts for 40 percent of the country's population and 48% of its GDP. The Metro air quality issues are different from the rural regions. The rural areas are affected by other pollutants such as smoke from wood fires emanating from home heating stoves. Over the last few years several cities such as Temuco, Chillán, and Talca have confronted challenges of contamination coming from the wood fire smoke emissions (CONAMA, 2002).

Alteration in fuel attributes has assisted in the reduction of the amount of sulphur from mobile and stationary sources. Additional efforts in addressing air pollutants have focused on the removal of lead from petroleum. Together these actions have substantially helped upgrade air quality. National environment air quality standards are more stringent for several air pollutants, such as particulate matter. Further protections have been added to the mix, including complex alerting systems which are used for emergencies. Widespread emission standards are nonexistent for industrial toxic air contaminants. Although air quality is checked and emission inventories

exist, few of the major cities and regions surrounding the copper smelters are involved with this process (*Environmental Review*, 2005).

Water pollution is also a major concern. Water contamination emanates from two problems, the circumstances connected with the hardness of the water, and the presence of pollutants. These pollutants come from assorted sources and activities. The main sources of pollutants originate from home residues. Agriculture pollutants appear from the use of pesticides and fertilizers, and industry generates a series of residues that are released into the streams, rivers, and oceans. Hopefully in the future the impact of domiciliary residues on the water resources will be reduced by the installation of water treatment plants in several cities (CONAMA, 1999).

During the late 1990s, Chile initiated a major water reform project linking the delivery of water supply and sanitation services. As a result, plans for the development and implementation of water infrastructure have increased considerably. This public policy comes in sequence with the regionalization and privatization of water companies. Two-thirds of the urban population is now connected to waste water treatment. Additionally, provisions are being established for urban sewage treatment to continue to increase. While most of Chile's bodies of water are of satisfactory quality, water quality remains below standards in some lakes, rivers, and coastal areas. This state of affairs exists mainly because of untreated urban and industrial sewage discharge. Regrettably, no water quality goals are concentrated on maintaining the ecosystems (*Environmental Review*, 2005).

### **SSM IN AN EMERGING ECONOMY: THE CASE OF POLAND**

On the other side of the world, Poland has embarked on an ambitious program of strategic sustainable management. The Polish government and Polish companies have made

substantial progress toward resolving the deficit, and they have developed strategic plans to accomplish major goals in a variety of areas including the environment, social responsibility, and human development through health and education.

As Poland made the transition from a command oriented economy to a free market economy, several issues of sustainability quickly emerged. For many years Poland had neglected its environment and the social responsibilities of being a nation. As the market economy has become a more pervasive way of life, Poland has had to think about its growth and development in terms of not just its present generation but how these economic development decisions will affect the future of the country. While the debate about sustainable development began in the second half of the 1980s when Poland was beginning its departure from a command oriented economy, new attention had already been focused on environmental goals, provoking questions about improving the efficiency of environmental policy. 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*).

### *Environmental Issues*

Poland continues to encounter environmental problems regarding air, water, and soil pollution, which require large investments and the participation of both the public and private sectors. 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 were 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, improved drinking water quality, reduction of groundwater pollution, and implementation and subsequent enforcement of integrated pollution prevention and control at industrial facilities. The National Municipal Wastewater Treatment Programme, adopted in late 2003, foresees the modernization and/or expansion of 1100 municipal wastewater treatment plants in over 1577 agglomerations and construction of 37,000 km of sewerage networks. This will be a costly undertaking, but it will generally resolve the major waste treatment issues necessary to meet EU standards. The newly elected Government is continuing with the Environmental Policy that was developed in the early 1990's (*Strategy for Poland, 2006*).

Poland's entry into the European Union (EU) in 2004 was a great economic stride forward, but, as a nation, it still continues to face 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 and to develop new solutions to meet future economic growth. Poland will need a continuous sustainable strategy that will allocate its resources sufficiently to meet future economic goals while simultaneously focusing 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 metropolitan districts due to the possible change in definition and interpretation of what a combustion plant means.

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 '*Aquis Communautaire*') (*Strategy for Poland*, 2006). Yet, while substantial progress has been made, several practical implementation issues have emerged. One example is the inadequate transposition and implementation of the EU Directive and Natura 2000 requirements. Making choices that adhere to the law and EU requirements, while 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*

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 the country 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 system had it not been reformed in 1999. Accompanying the trend of other Western countries where young people are delaying having children, there is in Poland a serious housing situation which makes family accommodation very difficult for young people. With housing being a problem and future employment opportunities requiring more education and investment of resources, Poland has some major sustainability issues that need to be debated. To

address these issues policy solutions need to be established that help build a population, housing, and employment situation that is positive for Poland's future generations (*Strategy for Poland, 2006*).

### *Education*

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. But there have been recent measures aimed at improving teacher pay. The quality of education in rural areas has become an issue because rural schools find it difficult to attract good teachers. Since 1989 the Polish higher education system has been modernized with state of the art teaching methods and a much broadened curriculum. The state sector's activities have been complemented by a flourishing private sector. The participation rate in higher education has risen sharply from around 10% during the 1980s to 35% in the 2003/2004 academic year. There were 274 private university-level schools in 2003/2004. Of the 1.86 million students in 2003-04, 546,000 were in private institutions, many of them in business schools (Ciegis & Gineitiene, 2008). The Constitution guarantees free higher education, but in practice most students pay some fees since the state universities claim to have enough government funding to provide only a limited number of free places. Competition between the state and private sector institutions seems to be intensifying with the private sector expanding daytime provisions at the same time as the state sector expands evening and weekend study. These are all good signs because they focus on the future and create opportunities for a sustainable future. Better education generally means better ideas and an openness regarding new thinking about the impact of old ways. It offers hope for a more enlightened citizenry and a society that is able to focus attention and resources on sustainable

development.

### *Health*

High alcohol consumption and smoking, prevalent in Poland, have been identified as a major health problem. Life expectancy at birth in 2003 was 70.5 years for males and 78.9 years for females. Poland also has a poor road safety record. In 2002 there were 152 road deaths per million in the population, the third- highest level in OECD after Portugal and Greece. The number of road deaths has decreased from 6,900 in 1995 to 6,294 in 2000 to 5,640 in 2003. The financing and management of health services was restructured in 1999. However, based on current information, these reforms were the least successful of the four major structural modifications launched by the centre-right coalition government of Jerzy Buzek. While everyone is able to obtain basic health care, improvements in quality and expansion of the services is an important direction in which Poland has been moving (Ciegis & Gineitiene, 2008).

To summarize, Poland has articulated a number of major initiatives that move it towards strategic sustainable development. For example, national environmental security objectives have been developed to make certain the biodiversity improvement of air quality is in accordance with climate change conventions and improving the quality of waters. 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 environmental funds operating at regional and local levels.

Poland has also 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 heuristics. Its legal framework for 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. Indeed, the nation has 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 capacity building and training programs to develop its administrative capacity regarding the environment on both the national and regional levels (Ciegis & Gineitiene, 2008).

All of these efforts are ongoing and are part of Poland's strategy for sustainable development. Finding sufficient resources to apply to extremely important competing projects is an enormous challenge. Nonetheless, SSM is about the future, and if countries are to have a vibrant future, policy makers must allocate the necessary resources to promote sustainability.

### **SSM IN EMERGING ECONOMIES: COMMON CONCERNS**

Emerging economies are areas of the world where managers need to think more deeply about the issues that are important for sustainability. For example, the food systems in many emerging nations neither meet the people's needs nor are environmentally sustainable. Many options exist for various industries involved in the food supply to create new products and processes that will sustain growth and deliver affordable food to markets where malnutrition is a problem (Stead, et al., 2003). Possibilities exist for firms to develop solutions to resolve public

health problems in developing economies by building more responsive health services systems. Additionally, water infrastructures and sanitation challenges provide opportunities for firms to ensure long term success by providing long term solutions.

Energy is necessary for new marketing alternatives. As such, strategic decisions by growing companies operating in emerging economies may include alternative energy sources, efficient energy technologies, and mechanisms that can provide energy conservation. Innovative information technologies provide many opportunities to facilitate the transition from resource based to knowledge-based economies in emerging economies. By addressing concerns such as these, strategic managers can expand their companies while making positive contributions to the social and natural capital of developing nations (Parnell, 2008; Stead, et al., 2003).

Although Chile and Poland qualify as emerging economies, they represent distinct nations with vastly different geographies, cultures, resources, and sustainability issues. Nonetheless, several key commonalities with regard to SSM are apparent. One of the primary issues facing both countries is the aftermath of long-term pollution, including the quality of air, water, and soil. Although the pressure clean up these former abuses is prevalent in both countries, Poland has the added weight of the EU and its stringent requirements on its shoulders.

The pollution problems are somewhat systemic, in that both require enormous resources that must be acquired and utilized during a time when other priorities are also begging for funding. Education issues, such as rural quality problems and the need for expanded higher education enrollments, are paramount in Poland, while Chile faces the need for dispersion of populations requiring additional infrastructure funding. While there are health concerns with both countries, Poland's are directly related to alcohol abuse and smoking, whereas Chile's health issues emanate from the need for better waste disposal and more modern hygiene

methods.

The overarching commonality between these developing economies is the conundrum of short-term necessities versus long-term needs. While both countries appear to be striving to improve their economies through partnerships between business and government, privatization, movement toward free trade status, and the presence of strong central banks, the success of these endeavors will take time and patience, particularly considering the need for the development of a strong middle class in each country that can make SSM practical. This process is aided, however, by internal political stability, external investment from corporations originating in already developed economies, foreign government assistance, and a public awareness of its citizenry as to the importance of long-term sustainability.

### **CONCLUSIONS AND FUTURE RESEARCH**

This paper presents an argument for concentrated SSM efforts in emerging economies, building on the cases of Chile and Poland. Both countries face short- and long-term sustainability concerns, mostly related to their ecologies that have been, in some cases, ravaged by past abuse. Simultaneously, however, both countries are partnering government with business to improve the economies of their populations, utilizing expanded free trade, privatization, and strong central banks. There is much pressure on both of these countries from external sources for rapid improvement of their environmental resources, particularly in the case of Poland and the EU, but internal pressures are constant in a number of areas such as education and infrastructure, as well. Both Chile and Poland must find a balance between immediate needs that ensure survival for their populations and long-term issues of economic and environmental sustainability.

Valuing posterity—believing that future generations of human beings and other species are key considerations—is instrumental in attaining a sustainable social and ecological balance.

A value for posterity can be an important ingredient in effectively managing the change and turbulence that all organizations now face and will continue to confront. A clear vision of the future is critical for organizational success. Visions serve as the common denominator around which strategic decisions are shaped and implemented. A shared vision in organizations encourages employees to think strategically, thereby enabling firms to manage opportunities and threats in ways that are advantageous to their survival and prosperity. Taking future generations into account in strategic decisions can also influence a wide range of choices. If strategic managers value *both* economic and environmental prosperity are important, then appropriate strategic decisions will likely follow (Parnell, 2008; Stead, et al., 2003; Svensson, 2006).

Several broad categories of research concerns associated with SSM have been identified. First, strategic management scholars are challenged to integrate both novel approaches to performance measurement and short- *and* long-term perspectives on the strategy-performance relationship. Longitudinal studies in the field have examined how a strategy's influence on performance changes over time, but most research continues to emphasize short- or intermediate term results at best and few address environmental sustainability, relying instead on accounting measures. Advances such as the balanced scorecard notwithstanding, few studies seem to have embraced a sustainability perspective when assessing organizational performance. This is true in both developed and emerging economies.

In a similar vein, 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. Most published strategic management studies are concerned with organizational performance in a free market economy and *appear* to overlook the fact that a key goal of a free market system is to enhance a society's quality of life. Likewise,

many 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.

Second, there is a need to develop robust models that facilitate effective resource management from societal and global perspectives while minimizing interference with free market systems (Hassan, 2003). This is a critical need in emerging economies like China, India and Eastern Europe where rapid economic development and movement toward capitalism challenges traditional approaches (Srivastava & Rehman, 2006). There are substantial economic and cultural differences among nations; indeed, the notion of SSM may have different connotations in different nations.

Third, the extent to which current strategic management models can be adapted to an SSM perspective is open to debate. Organizational outcomes are not always predictable and the environment is constantly changing (Grewel & Tansuhaj, 2001). The appropriate course of action is not always easy to identify when multiple perspectives are considered, as research concerning the link between strategic change and organizational performance is often inconclusive (Kraatz & Zajac, 2001). A number of studies have highlighted the complexity of this relationship, heavily influenced by factors such as the nature of the change, environmental turbulence, and industry structure (Mezias, Grinyer, & Guth, 2001; Parnell, 1994; Trinh & O'Connor, 2002).



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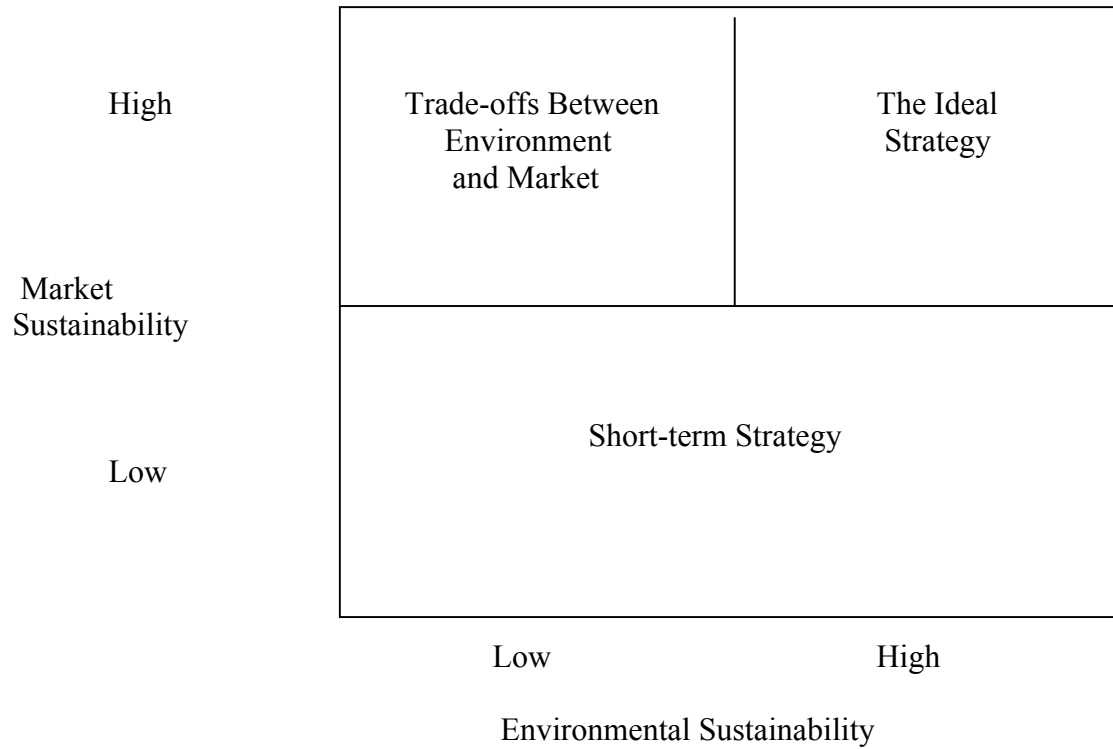
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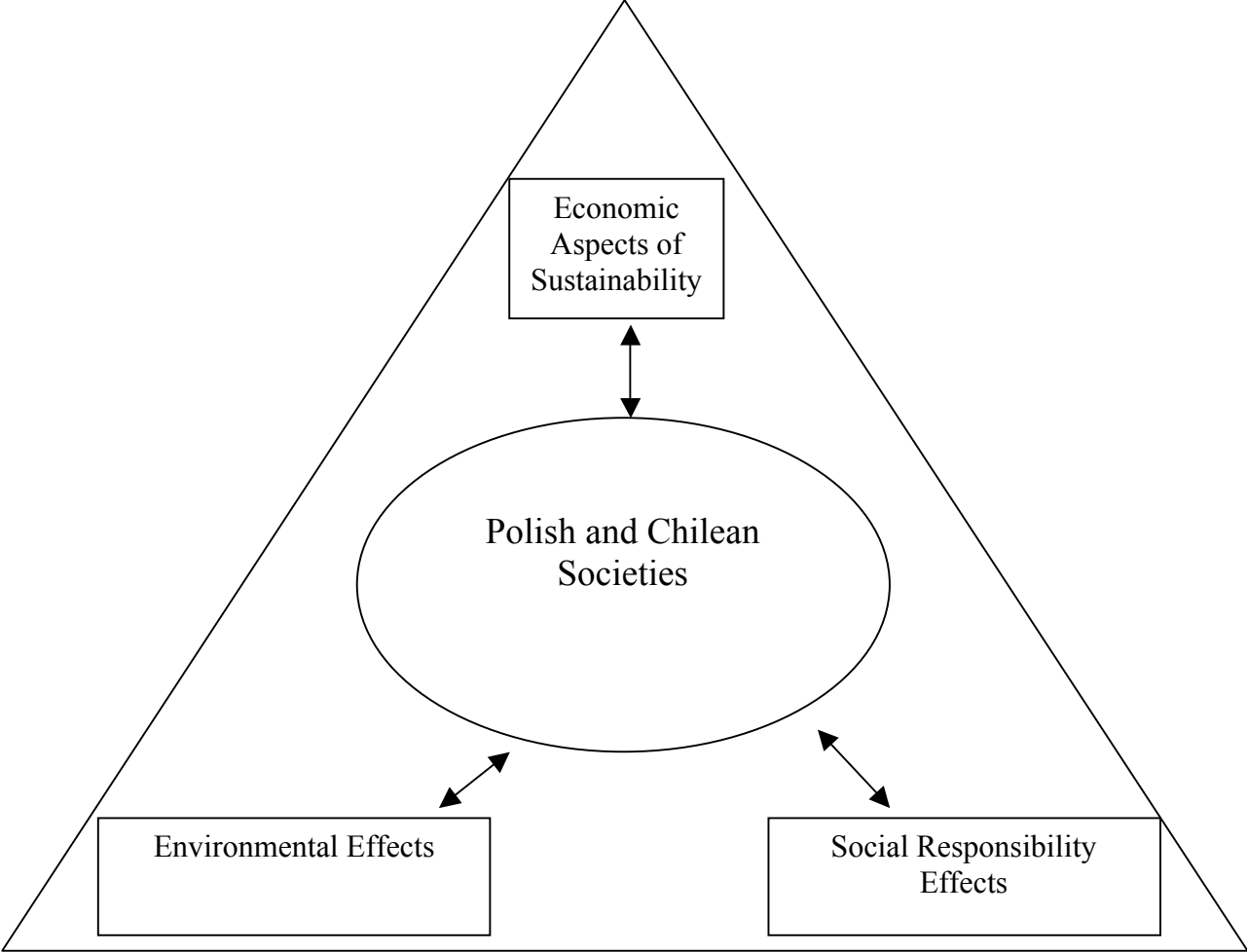
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**FIGURE 1**  
**MARKET SUSTAINABILITY AND ENVIRONMENTAL SUSTAINABILITY**



Source: Adapted from Parnell (2008).

**FIGURE 2 – The Triangulation Model of Strategic Sustainability**



Source: Adapted from Pflieger, et al. (2005).

# **THE SOCIOLOGICAL MECHANISMS GALVANIZING MANAGEMENT AND INFLUENCE IN CHANNELS**

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## **ABSTRACT**

This paper introduces a new model for the mediation process in channels when the seller meets the buyer. This area has traditionally seen research papers which focus on the power issues involved without examining the sociological issues which are the real processes and which parenthetically involve power sources and issues largely as an implied operant. In this paper a new model, the Activation-Expectations Model of Channel Influence is introduced. It involves the operation of two sociological mechanisms by which mediation is accomplished.

The same sources or bases of power are used here as in the former model, but they are here classified into the two new mechanisms not just classes, Coping Tactics and Persuasion by Reference. This is done to set on center stage these mechanisms from the bases derived by French and Raven and later extended by Brown and Lusch. Abstracted in this way they allow for the examination of channel mediating processes from a sociological perspective rather than from the perspective of power only.

The main task addressed in this paper is to relate these traditional sources of power to the new sociological mechanisms to allow this sociological examination to proceed.

## **INTRODUCTION AND LITERATURE SEARCH**

The focus of mediation studies in channels has traditionally been on power issues. There have been several leading researchers publish works in this area.

This focus on power itself has drawn attention away from the sociological mechanisms through, which mediation is accomplished. Power already present in latent form in the background becomes galvanized to an activated state by the mediation process or may even originate with this process in some cases.

In the new model here proposed, the Activation-Expectation Model of Channel Influence, two sociological mechanisms, Coping Tactics and Persuasion by Reference are proposed. These classify the traditional bases of power to abstract the two mechanisms from the list of bases in



general to research the power issues through the two sociological mechanisms instead of power itself.

In the last part of this model the affect from one or both of these mechanisms is compared to his/her expectation by the recipient of the influence attempt. This could lead to an understanding of which influence bases lead to motivation, de-motivation and business-as-usual, a tool to be used in managing channel operations.

In this paper the relationship between the traditional bases of power and the two proposed sociological mechanisms will be examined.

Earlier works in channel mediation have focused on classifying the bases of power in such a way as to explain the workings of the channel based on the sources of power themselves rather than on the sociological mechanisms by which mediation occurs and by which the channels function. Several writers have classified these bases developed by French and Raven and extended by Lusch and Brown and outlined in the Bases of Power Model. The goal was to gain a greater understanding of the channel operations and help practitioners understand which of the various combinations of power is the appropriate base of power to use in a given situation. There were various schemes used in this quest (Table 1) including coercive vs. non-coercive [7], Economic vs. non-Economic [3], weighted vs. non-weighted [1], direct vs. indirect [10], contingent vs. non-contingent [8]. Table 1 presents the dichotomies (and one trichotomy) drawn from this research to better understand channel functioning. It appeared to be a search for an organization of these bases which would explain all the complicated domain of influence in the mediating environment. Its focus on power instead of the mechanisms at work (which evoke power and are evoked by it in the relationships) may amount to the tail wagging the dog. There were so many articles in this stream of channel influence produced by so many prominent researchers that it attracted the attention of the present writer. It was felt that something was missing, something to galvanize power sources to an activated state or even to give birth to the power. The writer feels that power and the sociological mechanisms are so closely related and intertwined that they are practically inseparable. But the sociological mechanisms are the phenomena through which channel mediation takes place and could best explain channel operation. Power on the other hand is related and works with the mechanisms and may even be present before the mechanisms become galvanized in some cases. So, that “something” was the sociological mechanisms and placing them in the forefront of channel mediation.

Referring to Table 1, Column 1 shows the division between the sides of the dichotomy (one trichotomy) for several studies in the power stream of channels literature. The traditional bases of power from French and Raven associated with each side of the classifications tabulated in Column 1 are tabulated in the second column. But the focus here is on the operation of the two sociological mechanisms themselves which parenthetically evoke power and are evoked by it. In the third column appear the two sociological mechanisms through which channel mediation takes place, named Coping Tactics and Persuasion by Reference and are an integral part of the new model. As can be seen from the third column in Table 1 the division of the various sources of influence (power) associated with the sides of the dichotomies (one trichotomy) also align almost perfectly with the two mechanisms proposed for the new Activation-Expectation Model for Channel Influence. As can be seen in Table 1 there are only three exceptions to this parallel

alignment. First, in the Coercive / Non-Coercive case Reward and Coercive were divided and assigned to different sides of the dichotomy. Secondly, In the Direct / Other / Indirect trichotomy there were three sides to be considered, but if the Other bases are added to the Indirect Bases, the correlation between the two models would be restored. Thirdly, in the Contingent / Non-Contingent case, the legitimate base of power was not as yet divided between its two types. The correlation would be again restored if this division between legal and traditional legitimate were done. More insightful results may result from an examination of the broader concept of influence and the phenomena involved rather than examining the power associated by inference.

The frequent appearance there of, “Coping Tactics,” and, “Persuasion by Reference,” [2 ] appear frequently in Table 1 and this must be discussed. Coping Tactics are more tactical and aggressive, and the bases of influence included are in the vanguard of the sociological relationship and influence attitudes, sentiment and performance in the shorter term. Coping Tactics include reward, coercion and the legal legitimate sources of power from French and Raven’s Bases of Power which can all be manipulative in nature.

The, “Persuasion by Reference,” sociological mechanism includes all the bases of influence left after singling out those manipulative in nature. It includes all of internal mental processes, including perception, internalization and interpretation held by the influence recipient and evoked in the recipient by his/her desire to associate with the influencer. It is more passive in nature and holds all the influence recipient’s long term attitude related to the influencer. These attitudes are more centrally held and are amenable to change only after a longer term. Persuasion by Reference amounts to the perceived legitimacy of leadership as viewed by the influenced channel member. This right of leadership stems in part from a recognition of the power wielder’s expertise, a wish to be identified with him or her, and this leadership is seen as right when related to the power wielder’s domain. Persuasion by Reference included the expert, information, referent and legal traditional Bases of Influence.

The alignment of the Bases of Power in the six dichotomies in Table 1 exhibit only three discrepancies and all of these have been shown above to be an artifact of the basis chosen for classification or the bases of power included.

### **CLASSIFYING THE BASES OF POWER TO BETTER UNDERSTAND CHANNEL FUNCTIONING**

What follows is a discussion that works through four dichotomies and one trichotomy which are attempts to better understand the functioning and effects of the power mechanism in channels and each refers to the various power bases included in the Bases of Power Model discussed above. The result has been a comparison of the five schemes as discussed by Johnson, Koenig and Brown [9]. Most of the discussion following arose from their proceedings. The points from the schemes discussed and considered relevant to the present discussion appear in Table 1.

Hunt and Nevin [7] (Table 1) were the first writers to dichotomize the various Bases of Power in a meaningful way. Their paper centered on franchisee-franchisor relations, and French and Raven’s five Bases of Power were divided so that the coercive base was singled out on the Coercive side of their dichotomy while the other four, reward, expertise, referent and legitimate

source, coercion, has been isolated from the non-manipulative sources. Gaski [5] developed a compendium displaying all the empirical relationships between the main elements relevant to channel management found in the power channel literature up to that time. Appendix A displays all these relationships and makes one wonder which is the dog and which is the tail.

All the studies covered in Appendix A show a positive relationship between the satisfaction construct and the non-coercive sources and as one would expect a negative relationship between the coercive sources and the satisfaction construct. In all studies in Appendix A the conflict construct bears a positive relationship with the coercive sources and a negative relationship with non-coercive sources. Would it not be expected that the only source which depends on purely negative sanctions to function would do so differently in Gaski's composite picture from the other power sources?

Is this focus solely on power useful or is it a hindrance by encumbering the process of allowing the development of a more useful classification schemes by changing focus to the sociological processes involved in the channel mediation process? Later researchers have followed this Hunt and Nevin dichotomy [3] [1] [10] with the unfortunate side-effect of placing power at center stage in this research stream thus largely excluding work on other phenomena present.

The Economic / Non-Economic scheme was originated with Etgar [3]. The Economic side of this dichotomy, including the reward and coercion sources of power. These sources rely on incentives or disincentives from Economics to exert an influence. The non-Economic sources recognize the power-wielder's expertise in knowledge and expertise in the appropriate domain (expert power) a wish to identify with the power-wielder's perceived importance in his domain (referent power) and the legitimate right of the power-wielder to exert an influence (legitimate power). Legitimate power was later found to be represented by two cases, the legal legitimate case which became part of the Economic side of the dichotomy, and the traditional legitimate case, which falls in the non-Economic [3] side of the dichotomy, in extending the work of Etgar [3]. The roles of sociological and political factors impacting on influence are ignored in this research as the role of Economics only is used to classify the various bases of power. Therefore this classification by Etgar would not reflect the relationships between elements of managerial importance in any empirical sense. (Is this a case of admixing Economic data with conceptual-perceptual data?)

There are common characteristics between the classifications in the remaining dichotomies. These include the Weighted / Non-Weighted, Direct /Other / Indirect and the Contingent / Non-Contingent dichotomies.

In the third or Weighted / Non-Weighted dichotomy by Brown and Frazier [1]. The weighted sources all depend on the power-wielder to mete out consequences to accomplish mediation and cooperation. The other un-weighted sources work through the one influenced wishing to be associated with the influencer.

The fourth or Direct / Indirect / Other scheme is the only trichotomy to result from this work to classify the sources of power. It was first proposed by Kasulis, Spekman and Bagozzi in 1979 [10]. The direct sources include those which allow the power wielder to directly mediate outcome through coercion, reward, and legal legitimate. The indirect sources allow for only

indirect influence by the power wielder on the outcome as no resources are available. The other sources of power exert an influence due to their perceived value to the recipient of power.

The fifth or Contingent / Non-Contingent dichotomy, first outlined by John [8] relies on whether or not the source of power is predicated upon factors external to the relationship (and controlled by the power-wielder).

A consideration of these last three classifications, the Weighted / Non-Weighted, the Direct / Indirect / Other, and the Contingent / Non-Contingent reveals several similarities.

- 1.) The Weighed, Direct, and Contingent of the last three classification schemes depend on similar strategies to accomplish classification of the Bases of Power. In turn, they depend on the power-wielder's use of explicit resources to mete out consequences, use of direct mediation of consequences, control and application of factors external to the relationship. They appear to be close substitutes viewed from different perspectives.
- 2.) As a result, the classification of the various bases among the two elements of the three dichotomies are very similar. They could well become even more similar, should information and both legal and traditional legitimate sources also be included across all the studies.
- 3.) Should the Direct / Indirect / Other trichotomy [10] be collapsed to a dichotomy reflecting the power wielder's mediation (both direct and indirect) by combining other and indirect sources, the similarity would be strengthened again.
- 4.) The final similarity is the appearance in the sociological perspective in all five dichotomies of the, "Coping Tactics," and, "Persuasion by Reference," as a method of influence. This repeated appearance shows the similarities between the second cluster of power sources in each of the five studies and alludes to a lack of true significant conceptual difference between them and the Bases of Power putatively being classified.. These bases all result from a desire to associate with the influencer, the basis of the second sociological mechanism.

These similarities seem to suggest a somewhat natural division of the Bases of Power between the ones using force in some fashion to accomplish the desired behavior and the other Bases of Power working by a desire to find leadership in and association with the influencing firm. These are the Coping Tactics and Persuasion by Reference suggested in this paper and they represent entirely different sociological mechanisms. These are the Coping Tactics and Persuasion by Reference suggested in this paper and they represent entirely different sociological mechanisms. The position in this paper is that when the sociological view is used and the results are then compared with expectations and the surrounding circumstances a more accurate and useful model of channel influence methods and mediation tactics would emerge.

There are two additional points to be considered from Gaski's seminal 1984 article [5]. These are the exercised-unexercised bifurcation of both sources of power and of power itself.

**TABLE 1: The Six Dichotomies, Related Power and the Bases of Channel Influence (Johnson, Koenig and Brown, 1985) (From a Working Paper, Jacksonville State University**

<b>DICHOTOMY</b>	<b>SOURCES OF POWER</b>	<b>SOCIOLOGICAL MECHANISMS</b>
<b>COERCIVE</b>	<b>COERCIVE</b>	<b>-“COPING TACTICS”</b>
<b>NON-COERCIVE</b> (HUNT & NEVIN, 1974)	<b>REWARD, EXPERT, REFERENT, LEGITIMATE</b>	<b>-A POSITIVE REWARD -“PERSUASION BY REFERENCE”</b>
<b>ECONOMIC</b>	<b>COERCIVE, REWARD, LEGAL LEGITIMATE</b>	<b>-“COPING TACTICS</b>
<b>NON-ECONOMIC</b> (ETGAR, 1978)	<b>EXPERT, TRADITIONAL LEGITIMATE, REFERENT, INFORMATION</b>	<b>-“PERSUASION BY REFERENCE”</b>
<b>WEIGHTED</b>	<b>COERCIVE, REWARD, LEGAL LEGITIMATE</b>	<b>-“COPING TACTICS</b>
<b>NON-WEIGHTED</b> BROWN & FRAZIER, 1978)	<b>EXPERT, REFERENT, TRADITIONAL LEGITIMATE</b>	<b>-“PERSUASION BY REFERENCE”</b>
<b>DIRECT</b>	<b>COERCIVE, REWARD, LEGAL LEGITIMATE</b>	<b>-“COPING TACTICS”</b>
<b>OTHER</b>	<b>EXPERT, REFERENT</b>	<b>-“PERSUASION BY REFERENCE”</b>
<b>INDIRECT</b> (KAZULIS, SPEKMAN & BAGOZZI, 1978)	<b>INFORMATION, TRADN’L. LEGITIMATE</b>	<b>-“PERSUASION BY REFERENCE”</b>
<b>CONTINGENT</b>	<b>COERCIVE, REWARD</b>	<b>-“COPING TACTICS”</b>
<b>NON-CONTINGENT</b> (JOHN, 1984)	<b>EXPERT, REFERENT, LEGITIMATE</b>	<b>-“PERSUASION BY REFERENCE”</b>

Gaski states:

One distinction needs to be made between the exercise of power and the exercise of power sources. The exercise of power sources refers to an activity, the granting of rewards or imposition of punishments. The exercise of power refers to a result or outcome, the alteration of another’s behavior, irrespective of the means used to accomplish it (5, p. 24)

Sources of power then are those abilities or resources residing with the power-wielder which allow specific activities like manipulation and leading by example to exert an influence. Power itself refers to some result in a sociopolitical setting. Activated power is manifested by some outcome, the alteration of the recipient's behavior. These issues and how they are handled by the new model will be discussed at the end of the next section.

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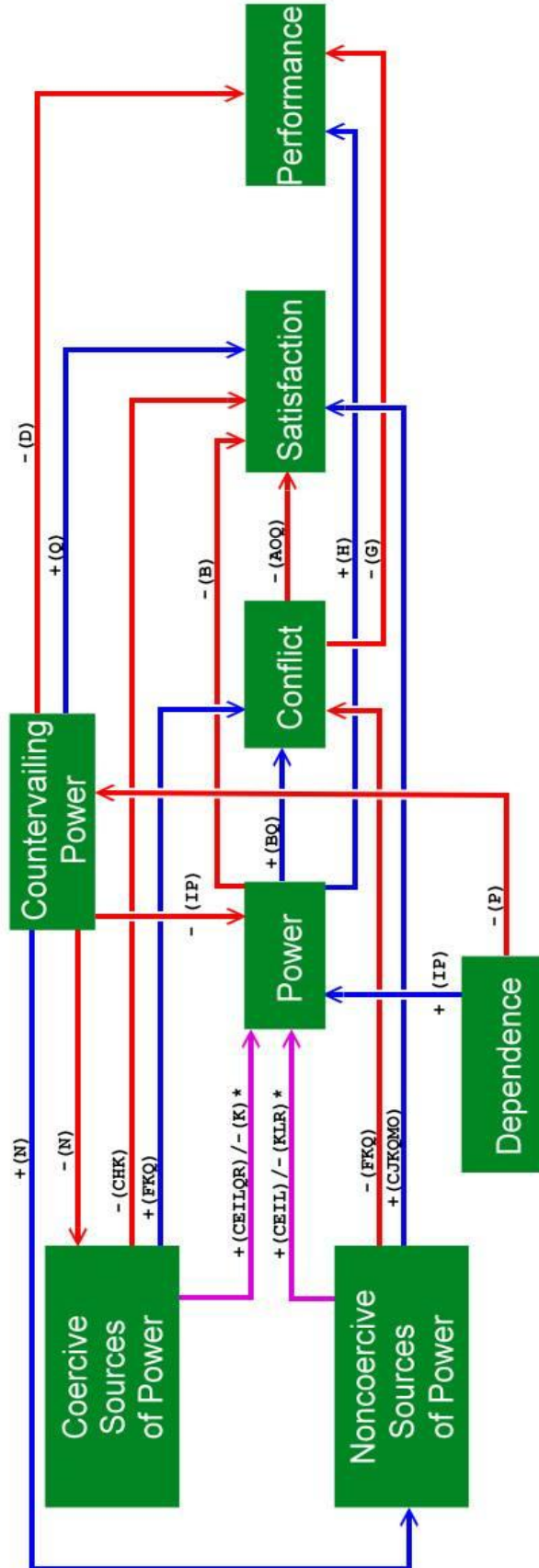
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APPENDIX A: THE THEORY OF CHANNEL POWER AND CONFLICT  
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Source: Gaski, John J. (1984), "The Theory of Power and Conflict in Channels of Distribution,"  
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+ = positive relationship

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Letters in parentheses refer to empirical grounds for each relationship:

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| G. Lusch (1976b)              | N. Wilkinson and Kipnis (1978) | of some relationships.            |



# **THE ACTIVATION-EXPECTATION MODEL OF CHANNEL INFLUENCE**

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## **ABSTRACT**

Within the channels management area there is a stream of literature on power issues which includes the Bases of Power and the Power-Dependence Models of power in channel. The types of power included in these studies were first set for by French and Raven, 1959 [6] and later expanded by Lusch and Brown [16] and Raven and Kruglanski [15]. This channels power stream includes several main articles which attempt to divide these bases of power into classes meaningful to our understanding of channels operation and to give guidance to practitioners. Appendix A shows how some sociopolitical and Economic issues relate from some of these central articles

All this work focused on the phenomenon of power in the channels setting moved the focus from the sociological processes in the channel to power itself which is an operant only and which results at least in part from these sociological processes. It is suggested here that these sociological mechanisms not power should occupy center stage in channel management studies. Set forth in this paper is another model of channel operations, the Activation-Expectation Model of Channel Influence. This model focuses firstly on two sociological mechanisms by which channel operations proceed and secondly on a comparison with a baseline of expectations by which the channel member receiving the influence attempt makes his/her judgment.

## **INTRODUCTION AND LITERATURE SEARCH**

Traditionally, studies into the phenomenon of channel operation have been viewed from the perspective of the power issues involved. These have utilized the sources of power identified by French and Raven and others including the reward, coercive, legitimate (both legal and traditional), referent, expert and information sources of power [6]. Attempts have been made to classify these sources of power into dichotomies (and one trichotomy) to further explain the operation of channels. These have included works by [6] [7][2][14][12] and others. These papers are focused on the power issues thus centering the discussion on this implied operant instead of the sociological mechanisms involved. These mechanisms are placed at the center in the new model proposed here as power itself is largely a result of the influence attempt.

The Bases of Power Model of channel operation were first suggested in the work of Dahl (1957) [3]. His model for the Bases of Power appears and will be discussed below.

**FIGURE 1: The Bases of Power Model (Dahl, 1957)**

<b>BASES (SOURCES) OF POWER</b>	<b>MEANS (INSTRUMENT) OF POWER</b>	<b>SCOPE OF POWER (RESPONSE)</b>	<b>AMOUNT OF POWER</b>
<ul style="list-style-type: none"> <li>-REWARD</li> <li>-COERCIVE</li> <li>-LEGITIMATE</li> <li>-TRADITIONAL</li> <li>-REFERENT</li> <li>-EXPERT</li> <li>-INFORMATION</li> </ul>	<p><b>RUNNING A PROMO. CAMPAIGN TO ENHANCE CHANNEL PARTICIPATION AND MARKET SHARE</b></p>	<ul style="list-style-type: none"> <li>-ENTHUSIASM</li> <li>-WILLINGNESS</li> <li>-NONCOMMITTALLY</li> <li>-RESERVED</li> <li>-BEGRUDGINGLY</li> </ul>	<p><b>A PROBABILITY STATEMENT RELATING PROBABLE OUTCOME (SCOPE) WITH THE LEVEL OF POWER UTILIZED</b></p>

The first stage in Dahl’s model is the **Bases (Sources) of Power** (Fig. 1) themselves and these include the various resources available to the power holder to exert influence on other channel members. These bases or resources become activated or energized and bring about a change in the behavior of another channel member. An example of this would be the decision to add an additional promotional element to enhance sales efforts.

The second stage is the **Instrument of Power (Means)** (Fig. 1) which requires some action by the power wielder that has an effect on the recipient. This could be the initiation of the additional promotional element mentioned under the bases of power above.

The third stage is the **Scope of Power (Response)** (Fig. 1) evoked in the recipient of the power or influence attempt. This could vary widely from positive support to negative sentiment and poorer performance.

The fourth and final stage is the **Amount of Power** (Fig.1). This is a probability statement relating probable outcome (Scope) with the level of power used. There must be sufficient power utilized by the Instrument to evoke a Base or Bases or Power exploited to accomplish the scope or change in behavior.

The new model being proposed in this paper, the Activation-Expectation Model of Channel Influence largely follows the conceptualization in Model 1, in spite of the fact that this new model focuses on sociological mechanisms of channel operations instead of power itself.

In the case of Gaski’s Manipulative or Ecological Power Model [7], there is a strong tie- in with the new Activation-Expectation Model and its two sociological mechanisms, Coping Tactics and Persuasion by Reference. So, the new model is well tied-in with previous conceptualizations.

## THE ACTIVATION-EXPECTATION MODEL OF CHANNEL INFLUENCE

The writer proposes in the new Activation-Expectation Model of Channel Influence (Fig. 2) that the focus on power in channels relationships placing power itself at center stage while ignores the sociological mechanisms at work even though power is but an implied operant resulting in part from these sociological mechanisms. It is suggested that there are two sociological mechanisms, Coping Tactics and Persuasion by Reference. The new model relates to both sides of the Political Economy Paradigm. It is further proposed that the influence attempts from these two sociological mechanisms are followed by a comparison with expectations. The results of this comparison affect channel performance and sentiment. This has relegating power to an implied or inferred role only, and taken it from the center of discussion while accepting that it naturally accompanies the two mechanisms.

Coping Tactics usually represent the first contact between the influencer and the influenced in channel influence relations. They also change more quickly with additional episodes. The channel influence functions by the influencer developing a program and then presenting it to the recipient he is attempting to influence. Coping Tactics operate through some manipulative action, using mostly Economic factors, to gain compliance with the influence attempt. The influencer uses some method of mediation to gain agreement. This can work in one of two ways. The benefits of the channel program can be associated with some gain valued by the influenced or to something he does not want. Alternately the influencer can use the terms of the channel contract. All these methods are manipulative in nature using Economic or Psychological influences to achieve compliance. Coping Tactics are a more aggressive method to gain compliance, exert influence more quickly but likely exert less influence overall than the Influence by Persuasion tactics. They are used less frequently probably due to greater possibility of negative sentiment developing among the influence recipients and they are used only when additional influence is needed. Their effect is more short term in performance and sentiment as it is more subject to change with the next episode. Comparing the new Model to the Bases of Power Model, Coping Tactics would be analogous to the reward, coercive and legal legitimate powers in the Bases of Powers

The Persuasion by Reference mechanism works by a very different sociological phenomenon. This is a wish on the part of the influenced party to comply and even emulate the influencer and his policies, coming from a deep sentiment of respect. The recipient of influence views the influencing firm as very knowledgeable about the product class and how the market function and the most appropriate promotions to use and also as being reliable and fair dealing. This form of influence is ever-present and no manipulation is used. As a result of this nature of Persuasion by Reference, the influenced firm wishes to associate with this firm and even perhaps to mimic it in some of its policies. Through this second mechanism the influencing firm is viewed as reliable in information, as having expertise in its operations, and is viewed by the as a leader with a legitimate right to influence. This influence mechanism is ever-present in the background of channel relationship and is an integral part of it. The Persuasion by Reference influences are less changeable and thus longer-lived and are a voluntary part of influence recipient's view of the influencing organization. They can be considered somewhat analogous to image in the consumer setting. In the Bases of Power, this would be analogous to the information, expert, referent and legal legitimate Bases of Powers.

When these two mechanisms of channel influence are cast in the Activation-Expectation Model of Channel Influence which couples them with Baldwin's baseline of expectation [1], channel influence would be viewed from a sociopolitical rather than a power perspective. Both of these mechanisms of channel influence when used or withheld in a manner consistent with expectations could be seen as supporting a business-as-usual scenario. They could be viewed as motivating when used in a more benevolent manner or de-motivating when used in a more malevolent manner than expected. This comparison of the influence attempt with expectations is one of the main points in shifting the examination of channel influence from a strictly power perspective to a sociopolitical one.

In the Activation-Expectation Model, the Coping Tactics and Persuasion by Reference sources of influence are latent, potential and ever-present in the relationship. These sources of influence become activated by the instrument. These sources were delineated by French and Raven [6] and later expanded and are classified here between Coping Tactics and Persuasion by Reference. The promotion of the Bases of Power (Dahl's Model, Figure 1) and the Sources of Channel Influence (the new model, Figure 2) by an instrument to an activated state is another point of integration of the two models.

The perspective presented in the new Activation-Expectation Model differs in three major ways from the view of power as the mechanism in channel influence. First, the Sources of Channel Influence include two sociological mechanisms, Coping Tactics and Persuasion by Reference as described above. These last two take the major focus away from power itself and put two sociological mechanisms on center stage instead. This change of focus to the sociological mechanisms is further enhanced by a comparison to expectations later in the model. These two sociological mechanisms have already been examined above.

Secondly, this new model emphasizes to a greater degree the elevation of the political and/or sociological influences to an activated state so they exert an influence. This elevation is accomplished by the instrument so that they become functioning influences rather than latent ones (see Activated Bases of Influence in Figure 2). In the new Activation-Expectation Model channel influence wielders use one or a combination of the Sources of Channel Influence to motivate channel behavior in the desired direction. Although this issue of galvanizing influence to an activated state is more emphasized in the new model, it once again shows a close association between the Bases of Power Model and the new model. This also shows a point of integration with the Power-Dependence Model, because there the perception of dependence to activate power is analogous to the power instrument to activate power. [5, p. 20]. So in the Power-Dependence Model, the dependence represents the social situation in which the two sociological mechanisms Coping Tactics and Persuasion by Reference reside. As the Bases of Power and Activation-Expectation Models fit so nicely together, the model of Dahl [3] and its terminology has been used to present the sociological concepts in the new model (Figure 2).

The third difference is the use of the baseline of expectations. This is the perception of each influence attempt against his personal baseline of expectations [1] by the recipient of that attempt to classify that influence attempt. There are three possibilities results, the influence could be seen as in accord with expectations, or it could be seen as more positive than expected and therefore be motivating. Finally, it could be viewed negatively and therefore, de-motivating.

Channel operation can be viewed as a series of sequential dyadic transactions where one dyad member (the seller) is attempting to sell to the next level of the dyad (the buyer). Should the seller exceed expectations in any facet of the negotiations such as price, deliveries, provision of special promotions or any other areas of operational uncertainty, the seller would likely have motivated the influence recipient and face enhanced sentiment and performance. When these various facets of performance fall short of expectations, the influence recipient would likely exhibit declining sentiment and performance. Should the influencer perform on these facets as expected, then the influence recipient would likely view this as business-as-usual and show no change in sentiment or operation. Whether the use, presence or suggestion of power is in line with the power recipient's baseline of expectations as seen through Baldwin's idea of positive or negative sanctions is the basis of the Scope of Influence Attempt. (Figure 2)[1].

The last part of the model, where influence attempts are compared with expectations is the Scope (Range) of Influence Attempt (Figure 2). It results in responses from the influence recipient to the use or simply the presence but non-use of a basis for influence. The Influence Attempt, is perceived and a subjective interpretation is made about the appropriateness of the use of this source of influence at this level of strength is in line with our expectations or not.

**FIGURE 2: The Proposed Activation-Expectation Model of Channel Influence**

<u>SOURCES OF CHANNEL INFLUENCE</u>	<u>INSTRUMENT (MEANS)</u>	<u>ACTIVATED SOURCES OF INFLUENCE</u>	<u>SCOPE OF INFLUENCE ATTEMPT</u>
<p><u>COPING TACTICS:</u>            -COERCIVE            -REWARD            -LEGAL            LEGITIMATE</p> <p><u>PERSUASION BY REFERENCE:</u>            -EXPERT            -REFERENT            -INFORMATION            -TRADITIONAL            LEGITIMATE</p>	<p>SOME MEDIATING ACTION BY THE INFLUENCE WIELDER TO INFLUENCE THE INFLUENCE RECIPIENT</p>	<p>SOME SOURCE OF CHANNEL INFLUENCE OR COMBINATION OF THESE ARE NOW GALVANIZED TO THE POINT OF BEHAVIOR OR SENTIMENT CHANGE</p>	<p>THE RECIPIENT OF THE INFLUENCE ATTEMPT COMPARES IT WITH HIS/HER EXPECTATIONS AND PERFORMANCE AND SENTIMENT ALTER ACCORDINGLY</p>

There are three possible perception of this attempt, 1.), it is in accord with the relevant baseline of expectations or, 2.), it is seen as a positive sanction as explained by Baldwin, or, 3.), it is seen as a negative sanction as explained by Baldwin [1].

The Outcome is a combination of Sentiment and Performance. Sentiment (political (liking, disliking or simply accepting the situation) and Channel Performance (Economic) enhanced, hindered or left unaltered by the situation) are both results of the comparison of the influence episode with subjective expectations. The episode could then be perceived as in line with expectations, and seen as a harmonious unchanged relationship, the outcome being business-as-usual. Secondly, the episode could be seen as more positive treatment than expected resulting in motivation and enhanced sentiment and improved performance. Finally, the episode could be perceived as more negative treatment than expected and be seen as the potential development of conflict in the relationship with an outcome of de-motivation resulting in more negative sentiment and potentially damaged performance.

An example might help clarify Figure 2. In a franchise channel, legal power is present but initially latent. A new promotional campaign (influence attempt) may result in motivation the channel and the ever-present Persuasion by Reference sociological mechanism would be the main Base of Influence present. Should it become necessary to evoke the contract, then the legal legitimate influence base is added to gain compliance and this means that Coping Tactics have been added. Finally, the influence attempt is perceived, interpreted and an outcome results (Scope of Influence Attempt section of the model). Legal power originally latent has been activated in this case.

In summary, the use or non-use of power in the channel setting when viewed through the Activation-Expectation Model become a simple matter of comparison with expectations are perceived as in line with expectations or as a positive or a negative sanction. The coercive, reward and legal legitimate bases (Coping Tactics) which are in the vanguard of influence, being manipulative, they involve methods by which the power wielder can apply manipulation to influence goals. Their perception as a positive or negative sanction or neutral is short-lived and subject to change with later episodes. The other bases, expert, referent, information and traditional legitimate, collectively forming the Persuasion by Reference are longer-lived in the minds of influence recipients. In the Activation-Expectation Model both Coping Tactics and Persuasion by Reference are compared to Baldwin's baseline of expectations to arrive at some outcome [1].

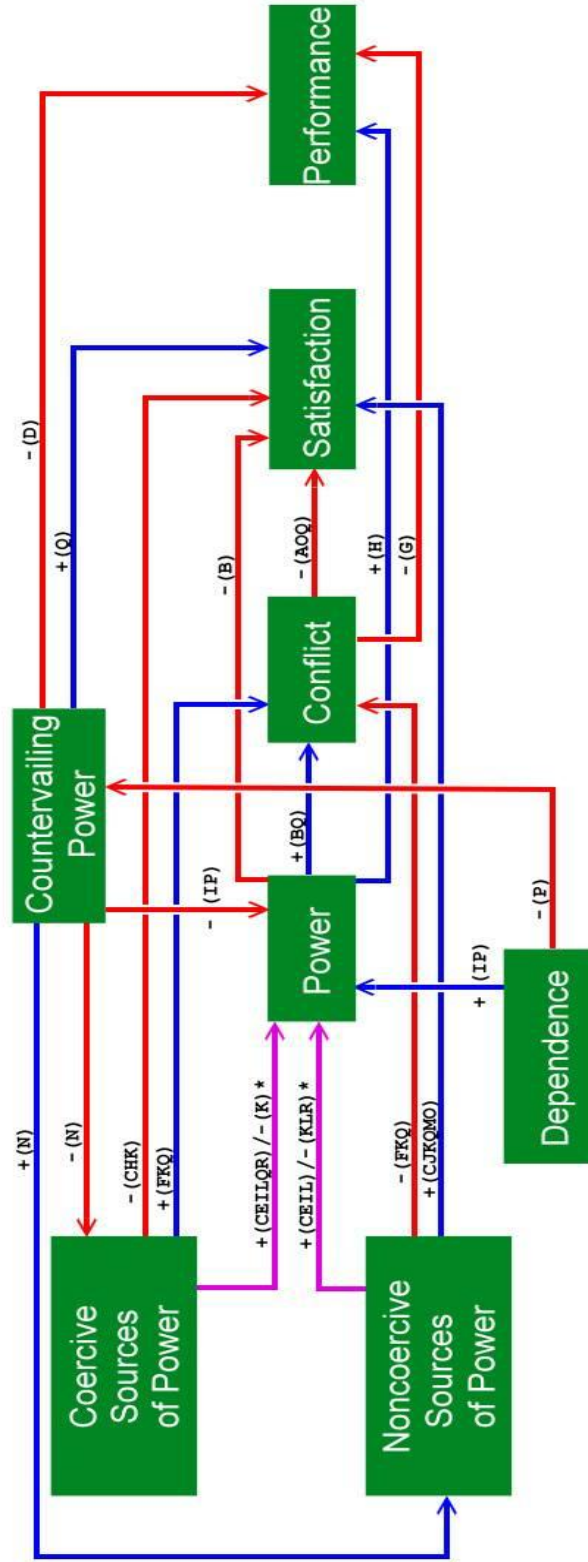
There are some issues, one of which occurs below, that arise when taking the traditional power perspective toward channel relations. When these same issues are viewed from the sociopolitical perspective of the new Activation-Expectation Model they become explained by the increased flexibility of the model and lose their strength. The following will use the terminology of traditional powers literature (i.e., power, Bases of Power, etc.). This was done because these became issues in the traditional channels power literature and is done in spite of the fact that the discussion focuses on how they are handled under the Activation-Expectation Model. Under normal circumstances when using this model this would suggest the use of the new sociological terminology (i.e., Influence, Influence Attempts, Scope of Influence Attempts, Perception of Influence Attempts, etc.).

The Activation-Expectation Model readily handles the exercised / unexercised power question as the model on the subjective evaluation by the power recipient using his / her baseline of expectations. Power could be directly applied or simply be present but dormant in the channel. It could be viewed as business-as-usual, as more benevolent than expected (motivating) or as more malevolent than expected (de-motivating).

The model therefore integrates well with The Bases of Power and Power-Dependence Models and addresses the coercive / non-coercive dichotomy in a sociologically-based fashion rather than through the inferred operant, power.

APPENDIX A: THE THEORY OF CHANNEL POWER AND CONFLICT  
 (A COMPENDIUM OF RESULTS FROM EMPIRICAL CHANNELS STUDIES)

Source: Gaski, John J. (1984), "The Theory of Power and Conflict in Channels of Distribution,"  
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+ = positive relationship

- = inverse relationship

Letters in parentheses refer to empirical grounds for each relationship:

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# After Stepping Off the Cliff from Office 2003 to 2007; Will the Next Step with Office 2010 be Smoother?

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### ABSTRACT

This session will provide a preview of the new Office 2010 (Beta) features as well as give an overview of the similar Ribbon user interface used in Office 2007. In Office 2007 the relocation of commands to the Ribbon caused a huge learning curve for experienced Office users and many felt switching to 2007 was not worth it. But with Office 2010 having the same “look” as 2007 with enhancements, the switch may be inevitable now. For the current 2007 users, the 2010 changes will provide even more features without the initial stress caused by moving from 2003 to 2007.

### SESSION OVERVIEW

The presentation will give a preview of the new Word and Excel features from Office 2010 Beta (full version due out in late spring of 2010) and compare similarities and differences between 2010 and 2007. Also covered will be features common to both versions. Participants will be encouraged to interact by asking questions and sharing their knowledge. The goal is to engage those attending and to try to provide information of value to participants.

### Office 2010 (Beta) Fundamentals

#### Ribbon

There are new features on the Ribbon with Office 2010 but the user interface is very similar to Office 2007. You can now customize the ribbon - create new groups, add commands, remove groups on a tab, reorder commands in a group. And you can import/export the customization to other computers. Adjacent to the Help “?” is a new symbol “^” that will minimize the Ribbon. Right mouse click, select **Customize the Ribbon**.

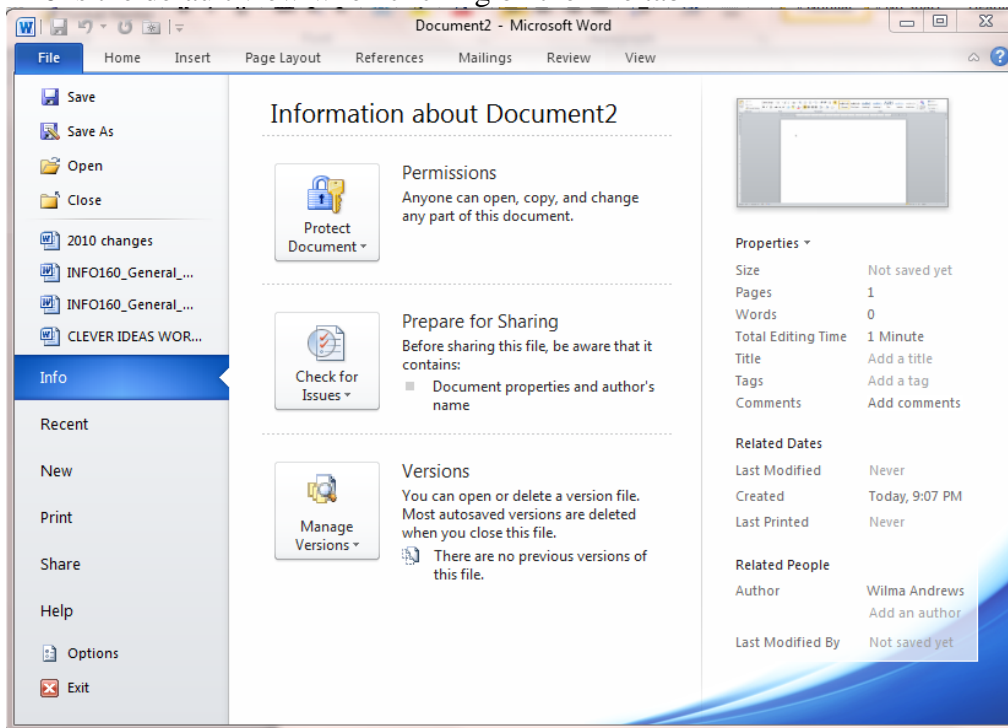
#### QAT (Quick Access Toolbar)

As in 2007, you can customize the QAT and now there is an option to import/export QAT to other computers as well. An added preset option is **Open recent file** which goes to the same view as the new **Recent** feature from the File tab.

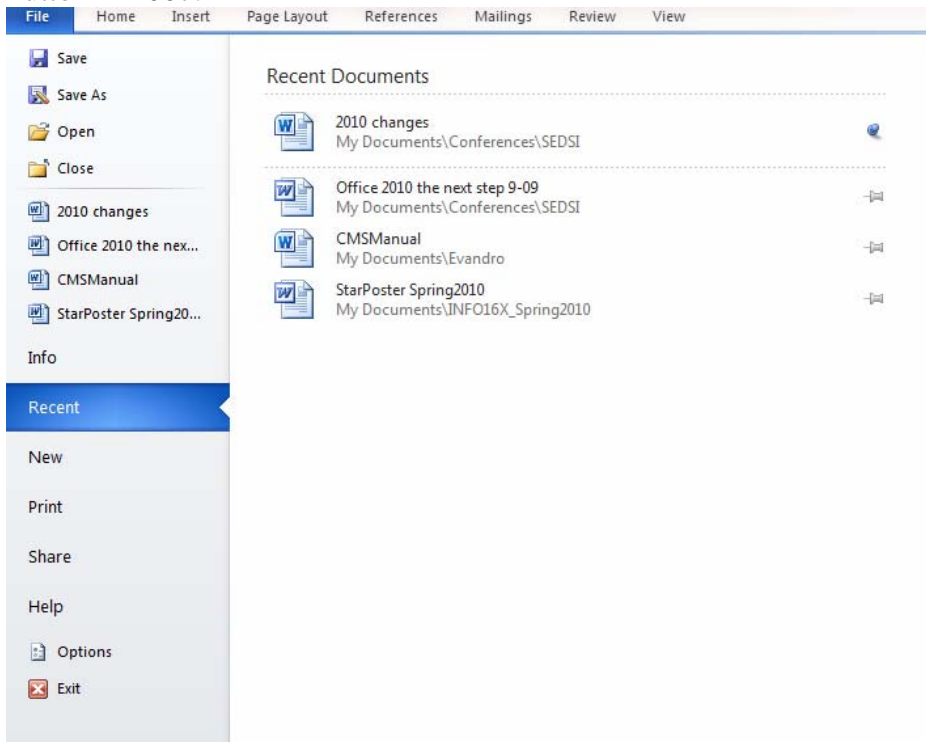
## File Tab

The 2007 Office Button has been replaced with the File tab and referred to as the Backstage View where you save, open, print, manage files and control the application options.

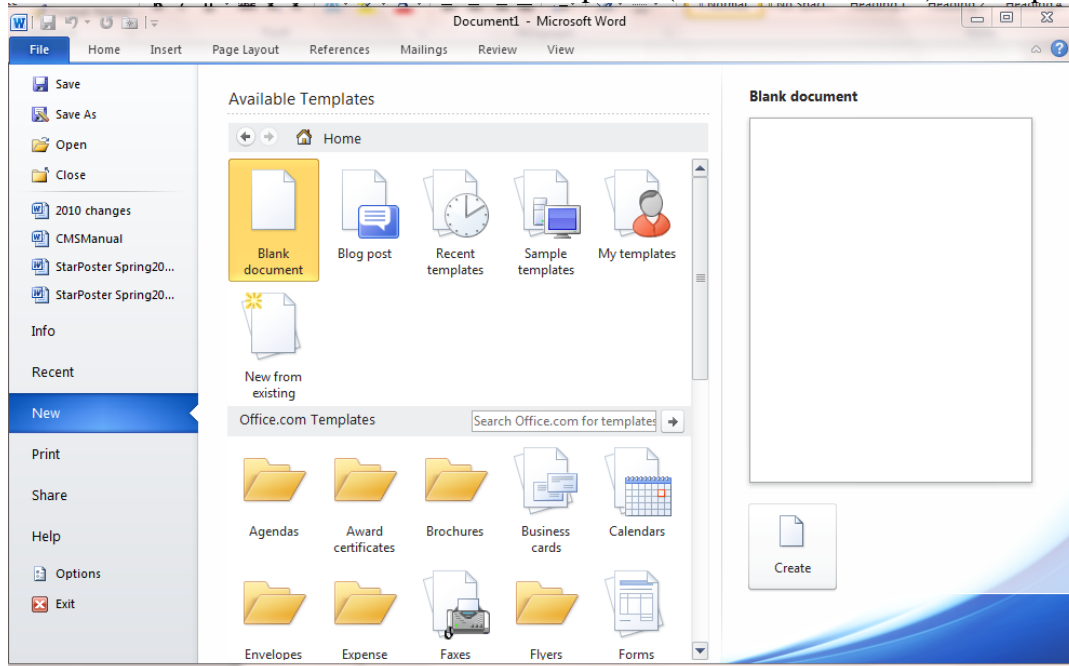
**Info** is the default view when clicking on the File tab



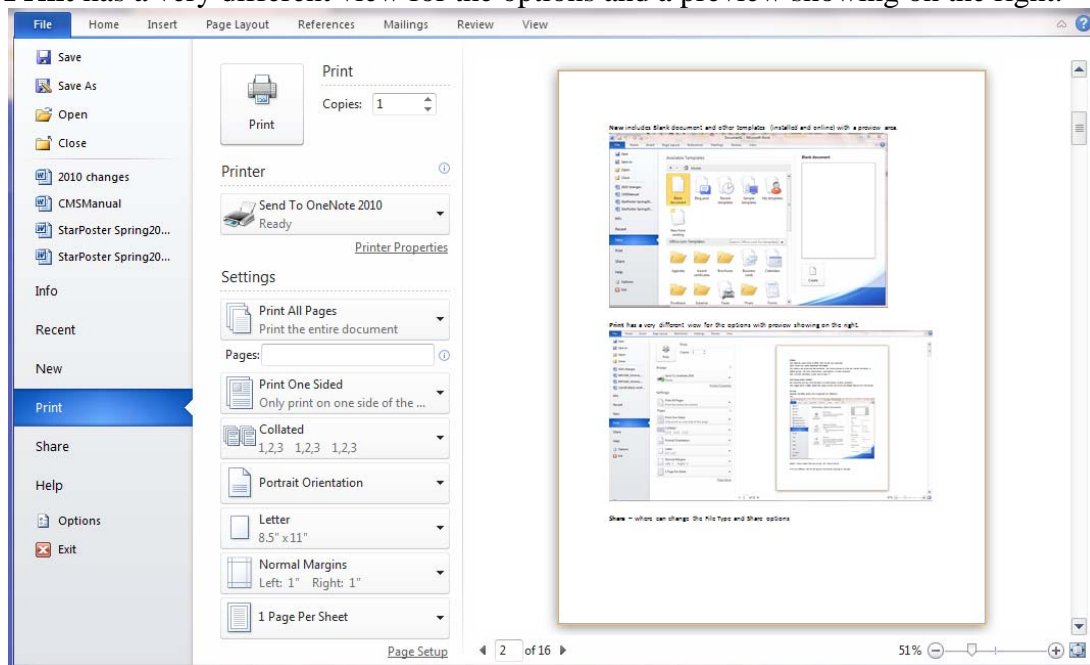
**Recent** – shows recent files and you can “pin” files to the list as you could with the Office Button in 2007.



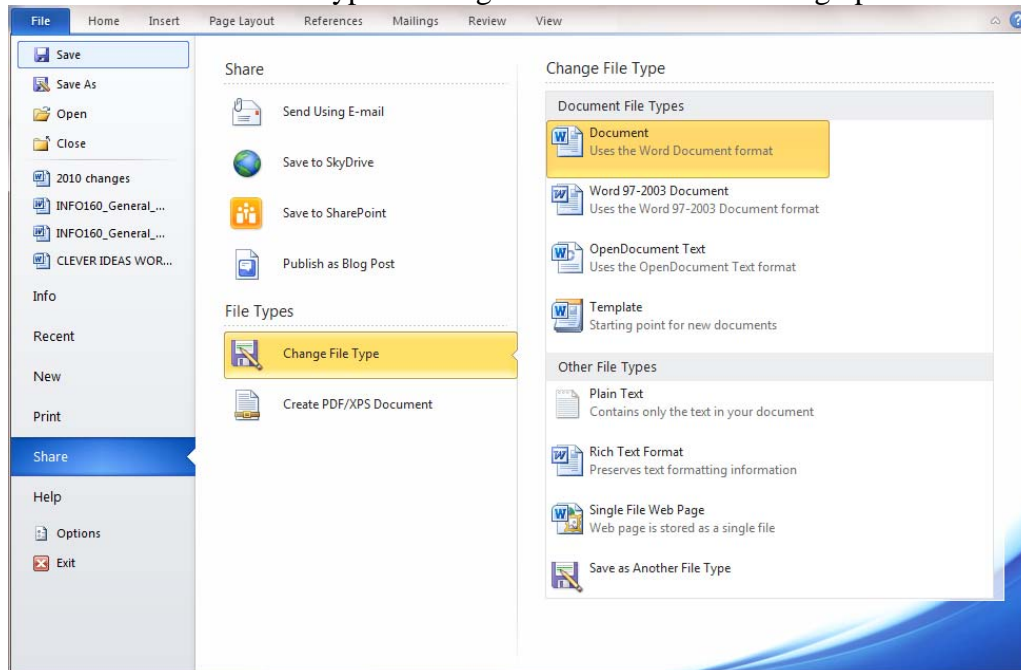
**New** includes Blank document and other templates (installed and online) with a preview area.



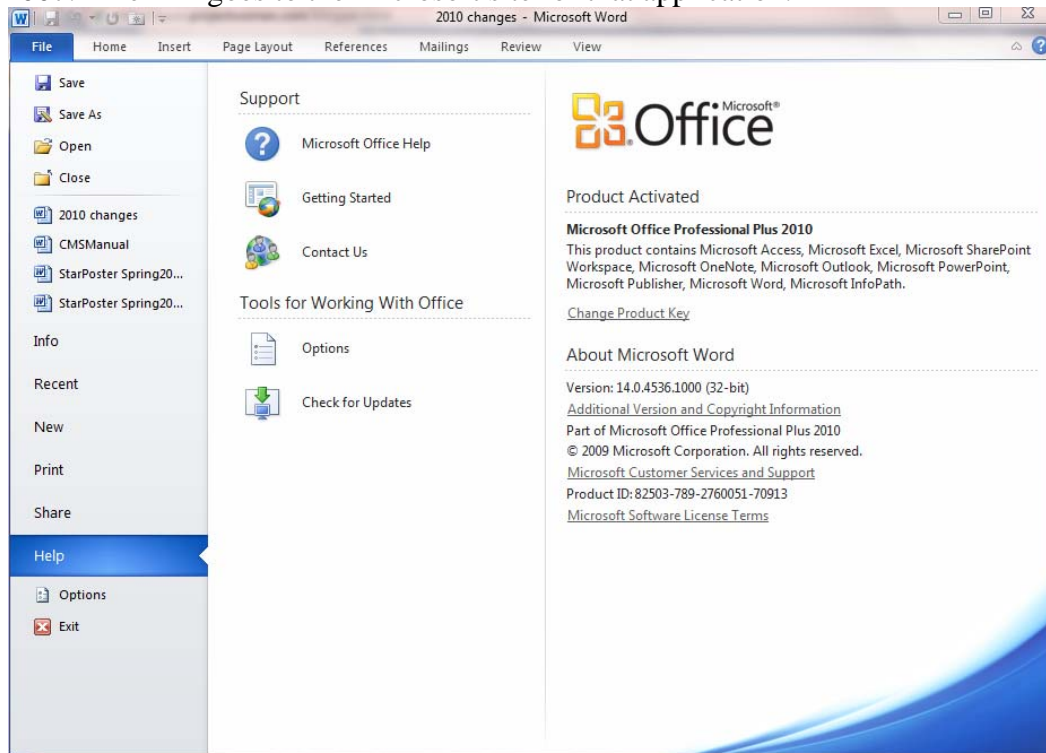
**Print** has a very different view for the options and a preview showing on the right.



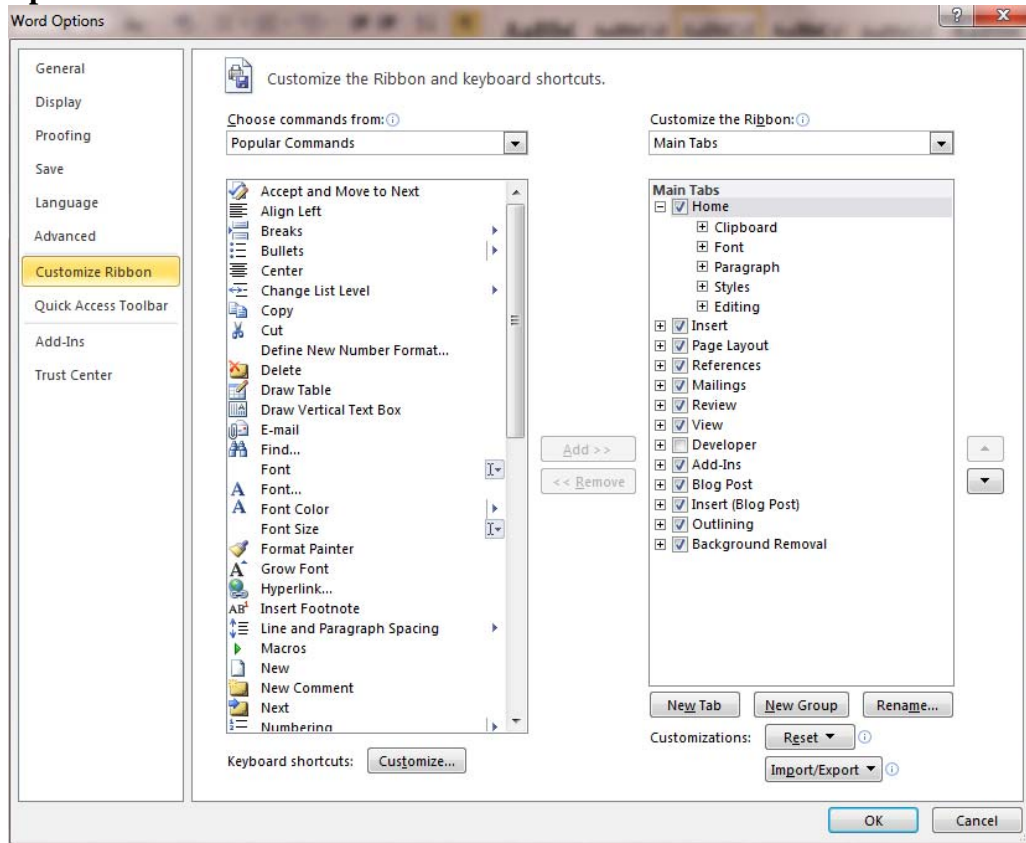
**Share** is where the File Type is changed as well as other sharing options.



**Help** has the typical features plus Getting Started link which replaces the Get Started tab in 2007. The link goes to the Microsoft site for that application.



**Options** – View is similar to Office 2007 but with **Customize Ribbon** and **Language** added.

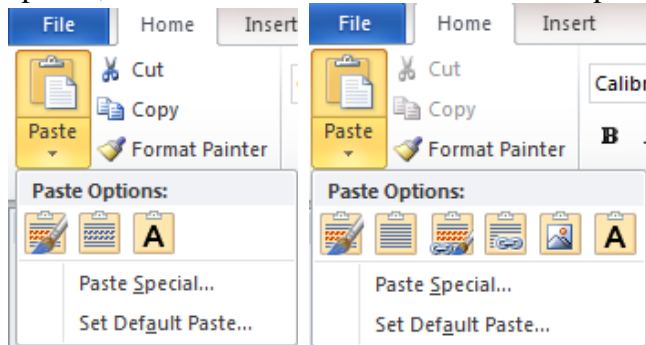


Some new tab features common to Word and Excel applications:

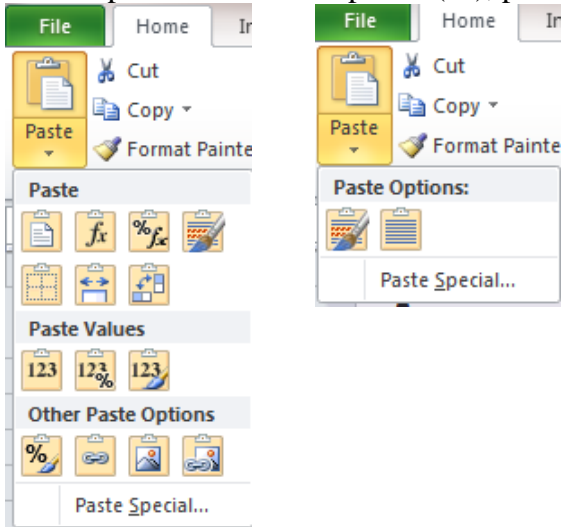
### Home tab

**Paste** – New icons are contextual depending on if the copy is from the application (1<sup>st</sup>) or from another application (2<sup>nd</sup>).

**Word** paste options (1<sup>st</sup>) - Keep Source Formatting, Merge Formatting, Keep Text Only, Paste Special, Set Default Paste. Paste from Excel options (2<sup>nd</sup>).

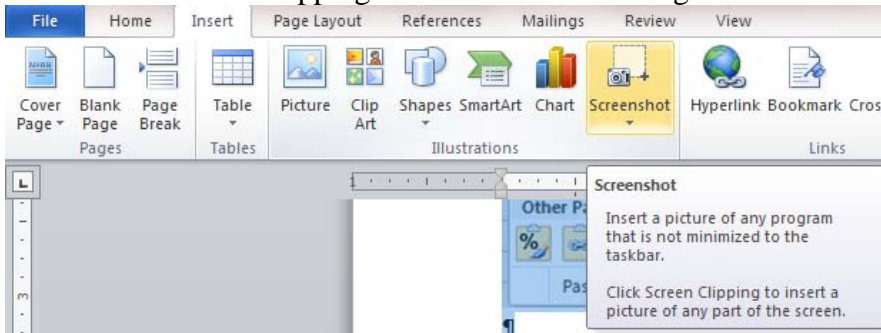


**Excel** – paste from Excel options (1<sup>st</sup>), paste from Word document (2<sup>nd</sup>).

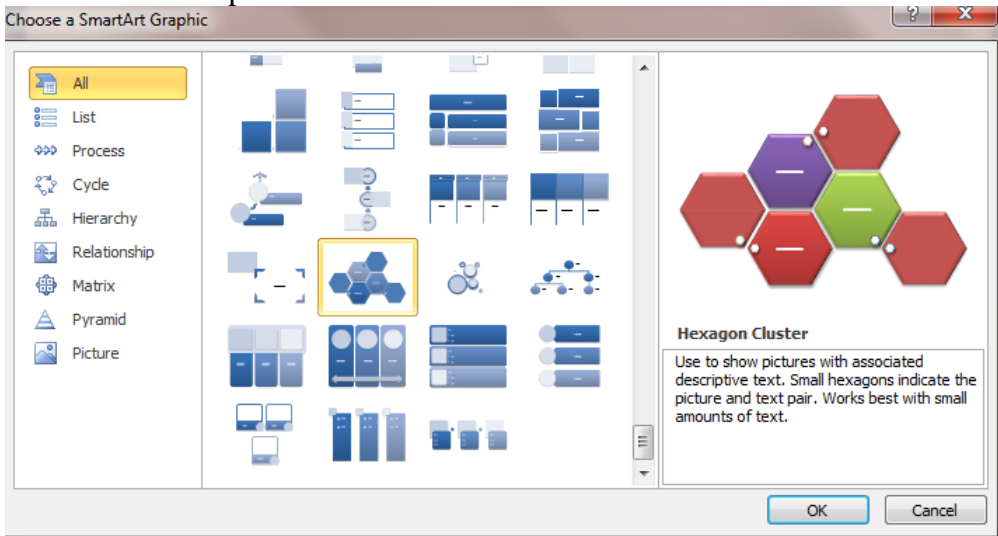


**Insert tab**

Screen Shot/Screen Clipping – contextual tab of image includes new photo editing features



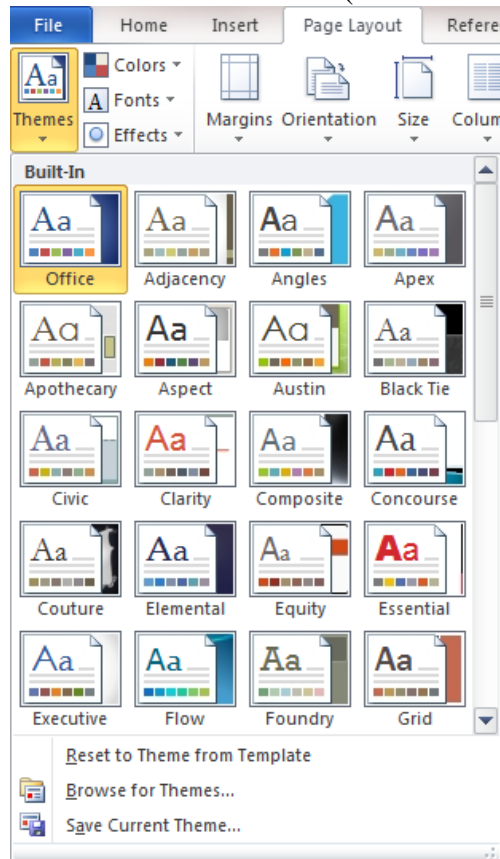
**More SmartArt Options**





## Page Layout tab

Themes – 40 are installed (vs. 20 in 2007) and more will be available online.



## Office 2010 new features by applications

2010 continues along the trend to provide options for enhancing output and functionality of files.

In **Word**, added to the previous 2007 features are additional themes and SmartArt graphics. Image editing has been added—as well as additional text effects with OpenType format for scalable fonts. There are new fixed digit numbering formats. For navigating thru a document there are new features at the Navigation pane where whole sections can be moved, searched, or promoted/demoted.

In **Excel**, Pivot Tables have a new feature called slicers which are visual ways to filter data in Pivot tables. Pivot Tables also have improved performance and enhanced filtering. Table enhancements include being able to filter and sort regardless of location within the table. There is a set of more accurate statistical functions with improved accuracy and consistency. Solver has new features. Sparklines – tiny charts that fit in a cell - provide new visualization of data. Charting capacity has been greatly expanded allowing for a larger number of data points. Conditional formatting has new icons sets and data bar options. Formulas can now be typed into Textboxes and are no longer restricted to being in a separate image created by equation editor.

## **Developing Your Own Instructional Materials for a Quantitative Class**

Session Chair: Barry Wray, UNC Wilmington  
Panel Members: Bob Andrews, Virginia Commonwealth University  
Hope Baker, Kennesaw State University  
Kellie Keeling, University of Denver

This session will present examples of material developed for a specific course. These include textbooks, supplemental instructional text, questions to be used with clickers and electronic aids such as simulations and video. Presenters will describe their experiences, along with tips, pitfalls to avoid and important things to consider when developing such materials. The presenters will also discuss the cost/benefit of developing your own material. Advice will include ways to use these materials effectively to promote learning.

We have 4 experienced panelists that cover the range from writing text materials for a statistics class to providing supplemental materials for clicker questions and electronic simulations and videos.

## Teaching the Difficult Topics in Statistics: What are they? What has been Successful and What has not been Successful?

**Moderator:** **Barbara A. Price**, Georgia Southern University, Department of Finance and Quantitative Analysis, Statesboro, GA 30460, 912-478-5775,  
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This session will be an open interactive moderated discussion among the panel and those in the audience. Participants will be encouraged to share those things that have worked well and those that did not work well. Each of the panelists will share a brief overview of his/her *history* with teaching statistics and his/her *Top Difficult Topics*.

Topics will include but not restricted answering the questions on how we get students to understand.....

- sampling distributions, particularly to students who lack significant mathematical preparation
- standard error of a statistic and its role in confidence intervals and hypothesis testing for a mean and/or a proportion
- outliers: when to remove (not to remove) unusual observations
- when to separate groups for analysis
- error assumptions in simple linear regression and the importance of verifying assumptions
- how to identify nonlinear trends and how to model them appropriately
- transformations, particularly logs, in regression curve fitting
- the relative importance (or unimportance) of  $R^2$
- why time series need to be treated differently
- discrete versus continuous random variables – the differences when computing probabilities
- using common sense to identify answers that do not make sense
- managerial versus statistical significance

These difficult topics – and others, why we feel they are difficult, *failures* in conveying the topics, and *successes* will be shared. Then, the floor will be opened for questions, observations, and open discussion. The objective of the panel is to help those who teach statistics to achieve learning of these difficult topics.

## **Course Content for Business Statistics: What Should it be and How Should it be Delivered?**

### **Session Organizer and Moderator**

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### **ABSTRACT**

What is the statistical knowledge that all undergraduate business graduates should know to be prepared for either the current workplace or graduate school? What is the most effective way to guide students in a way that gets them beyond memorizing mechanics and encourages them to think statistically? How is the academic, business and technology environment driving changes in the statistics curriculum and delivery methods? How are new technologies and constrained budgets affecting statistics instruction?

### **SESSION OVERVIEW**

This session will address statistics course content for students in business. The participants, who bring a diversity of experience with statistics instruction, will present their perspectives on content and methods of delivering the content, as well as environmental conditions that are driving or constraining what and how statistics content is being delivered to business students. Audience members will also be encouraged to ask questions and provide their perspectives on these issues.

### **CONTENT AND DELIVERY ISSUES**

Course content depends on several factors. In most business programs statistics courses are considered as foundation or service courses for business majors. Hence the level of the course, prerequisites for the course, the statistical procedures used in the following courses, and anticipated professions of graduates all have valid influence on course content. The statistical knowledge and the motivation of the instructors will also influence the content. Some instructors teach what they know best and feel the most comfortable teaching. Content and delivery method determined by what is most comfortable to the instructor may not be the most beneficial for the students. In business classes the learning styles of the students may be very different from those individuals who teach statistics. Since our classes tend to be textbook based the course content and delivery also depends on the available texts and supporting ancillary materials. Also a common complaint is that students do not read the text so a challenge is to select a text that students will read and one that will effectively communicate the desired knowledge. When selecting a text, one must consider that the audience for the statistics text is the student with no knowledge and raised in a different generation rather than selecting something that is personally appealing.

Historically statistics classes have had strong mathematical basis with the presentation of methods and materials being presented using this mathematical foundation. Students with different learning styles often find such a presentation difficult to understand and do not find it engaging. If students are not engaged in the learning process they tend to do the minimum to get through the class and may retain little from the class in the long term, other than how difficult it was for them. Will students retain more if they are assigned experiential exercises rather than being asked to work homework problems on specific sections of the text? Some believe that experiential exercises are better for teaching problem solving than just working the typical end of section exercises. Learning how to perform certain mechanics has to be essential in a statistics class but should not be the only thing learned in the class.

Many of the current statistics instructors obtained their statistics instruction in a time when obtaining adequate data was a major issue. Today's students will be functioning in an era where in many areas there will be no lack of data, but the major issue will be determining what slices of data will help answer the important questions rather than getting enough data to answer the question. This world will still be filled with uncertainty and the quantity of data will not eliminate the need for statistical thinking. However, memorizing yesterday's mechanical methods will not adequately prepare today's students for their tomorrow filled with data and computational tools for analyzing these data.

The challenge is to determine exactly what students need to learn to equip them for the future and to determine what method of delivery will be most effective for the students and the instructor. Some people believe that a typical course spends too much time trying to cram too many facts, techniques and methods into student's heads rather than communicating an understanding of fundamental principles and demonstrating how these can be applied in their professional and personal lives. A desirable goal would be for students to finish the class with an appreciation of the value of statistics rather than a joy of knowing that the class is finally over.

## ON GENERALIZED FIXED CHARGE PROBLEMS

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### ABSTRACT

This paper develops a heuristic algorithm based upon the Balinski approximation solution method for a fixed cost transportation problem. In light of the absence of a widely applicable exact method for solving fixed charge problems, the heuristic algorithm presented in this paper should prove useful in dealing with such fundamental nonlinear problems. A numerical example is presented to illustrate the proposed method.

### INTRODUCTION

The fixed charge problem (FCP) is a nonlinear programming problem of practical interest to business and industry. However, the existence of fixed charges in its objective function has prevented the development of any extensive theory for solution of the FCP. Some authors [4, 6] have developed heuristic adjacent-extreme-point algorithms for the general FCP. Since there is no guarantee that the solution obtained in the final iteration is a minimum (local or global), they experiment with substituting different combinations of variables into the basis to obtain better results. However, the criterion used to stop the simplex iterations (positive gradients between the location identified in the final iteration and its neighboring peaks), while sufficient for a linear program (LP), does not guarantee optimality for the FCP.

Most of the recent efforts are concentrated on finding solution methods for FCTPs. Two widely known methods for an FCTP are the ranking-the-extreme-points method [8, 10] and the branch-and-bound method. Gray [7] attempted to find an exact solution by decomposing it into a master integer program and a series of sub-programs. In contrast, Palekar et al. [9] provided exact algorithms based on the branch-and-bound method, applicable to small problems only.

Since the available exact algorithms generally require long computation times and large amounts of storage, Diaby [5] investigated heuristics for FCTPs. Balinski [3] replaced the nonlinear fixed-charge objective function with an approximate linear objective function and solved the resulting problem using the standard transportation algorithm. Adlakha and Kowalski [1, 2] presented approximation methods for regular FCTPs.

In this paper we develop a heuristic algorithm for the fixed charge problem. The algorithm is inspired by the ideas introduced by Balinski for fixed cost transportation problems and provides an extension of his work to general FCPs. In the following sections, we discuss the formulation of the fixed charge problem and reiterate FCTP formulation along with Balinski approximation [3]. We expand the discussion to develop the proposed heuristic algorithm. A numerical example is presented to illustrate the proposed method.

## THE FIXED CHARGE PROBLEM (FCP)

The fixed charge problem can be stated as:

$$\mathbf{P:} \quad \text{Minimize} \quad Z = \sum_{j=1}^n (c_j x_j + f_j y_j) \quad (1)$$

$$\text{s.t.} \quad \sum_{j=1}^n a_{ij} x_j = b_i \quad \text{for } i = 1, 2, \dots, m \quad (2)$$

$$\begin{aligned} x_j &\geq 0 && \text{for } j = 1, 2, \dots, n \\ y_j &= 0 && \text{if } x_j = 0 \\ y_j &= 1 && \text{if } x_j > 0 \end{aligned}$$

$$a_{ij}, b_i, c_j, f_j \geq 0$$

If all the fixed charges  $f_j$  are zero, then problem P would be a linear programming problem. In practice, fixed charges are frequently incurred whenever the initiation of an economic activity at a positive level caused the firm to incur a lump sum charge. The magnitude of the fixed charges is assumed to be in no way influenced by the level of the initiated activity.

### The Fixed Charge Transportation Problem (FCTP)

One of the most common types of problem that arises in many practical setting is a transportation problem where there are fixed charges for transporting goods between supply points and demand points. The fixed charge transportation problem can be stated as:

$$\mathbf{TP:} \quad \text{Minimize} \quad Z = \sum_{i=1}^m \sum_{j=1}^n (c_{ij} x_{ij} + f_{ij} y_{ij}) \quad (3)$$

$$\text{s.t.} \quad \sum_{j=1}^n x_{ij} = a_i \quad \text{for } i = 1, 2, \dots, m \quad (4)$$

$$\sum_{i=1}^m x_{ij} = b_j \quad \text{for } j = 1, 2, \dots, n \quad (5)$$

$$\begin{aligned} x_{ij} &\geq 0 && \text{for all } (i, j), \\ y_{ij} &= 0 && \text{if } x_{ij} = 0 \\ y_{ij} &= 1 && \text{if } x_{ij} > 0 \end{aligned}$$

$$a_i, b_j, c_{ij}, f_{ij} \geq 0$$

### *Balinski approximation method for FCTP*

Balinski [3] observed that there exists an optimal solution to the relaxed version of the FCTP (formed by relaxing the integer restriction on  $y_{ij}$ ), with the property that

$$y_{ij} = x_{ij}/m_{ij} \tag{6}$$

where  $m_{ij} = \min(a_i, b_j)$  (7)

So, the relaxed version would be simply a standard transportation problem with unit costs as  $C_{ij} = c_{ij} + f_{ij}/m_{ij}$ . Balinski claimed that under fairly general conditions his proposed approximation technique would yield close to optimal solutions to FCTP.

### Extending the Balinski Approximation to FCPs with Bounded Variables

To start, for simplification, let us assume that for problem **P**,  $0 \leq x_j \leq m_j$  for all  $j = 1, 2, \dots, n$ . Now consider a relaxed version of problem **P**:

$$\begin{aligned} \text{Minimize} \quad & Z = \sum_{j=1}^n (c_j x_j + f_j y_j) \\ \text{s.t.} \quad & \sum_{j=1}^n a_{ij} x_j = b_i \quad \text{for } i = 1, 2, \dots, m \\ & 0 \leq y_j \leq 1 \quad y_j \text{ integer} \end{aligned} \tag{8}$$

$$0 \leq x_j \leq m_j y_j \quad \text{for } j = 1, 2, \dots, n \tag{9}$$

Therefore, the relaxed version of the FCP is an LP where  $y_j$  are constrained to be integers.

Now consider the following LP problem **P'** where  $C_j = c_j + f_j/m_j$

$$\mathbf{P'}: \quad \text{Minimize} \quad Z = \sum_{j=1}^n C_j x_j \tag{10}$$

$$\text{s.t.} \quad \sum_{j=1}^n a_{ij} x_j = b_i \quad \text{for } i = 1, 2, \dots, m$$

$$0 \leq x_j \leq m_j \quad \text{for } j = 1, 2, \dots, n$$

**Theorem 1:** The optimal value of **P'**,  $Z(P')$ , provides a lower bound to the optimal value  $Z^*(P)$  of the corresponding FCP, problem **P**.

### EXTENSION TO THE GENERAL FCP

Consider the following classical LP problem:

$$\mathbf{LP}: \quad \text{maximize} \quad Z = \sum_{j=1}^n C_j x_j$$



$$\begin{aligned} \text{s.t.} \quad & \sum_{j=1}^n a_{ij} x_j = b_i && \text{for } i = 1, 2, \dots, m \\ & x_j \geq 0 && \text{for } j = 1, 2, \dots, n \end{aligned}$$

### Modified Linear Programs

In this section, we introduce a new sub-LP formulation. For each  $j = 1, 2, \dots, n$ , consider the following MaxLP<sub>j</sub>:

$$\begin{aligned} \text{MaxLP}_j: \quad & \text{maximize } Z = x_j && (12) \\ \text{s.t.} \quad & \sum_{j=1}^n a_{ij} x_j = b_i && \text{for } i = 1, 2, \dots, m \\ & x_j \geq 0 && \text{for } j = 1, 2, \dots, n \end{aligned}$$

Let  $x_j^{\max}$  denote the optimal solution of problem MaxLP<sub>j</sub>. In case the upper bound  $m_j$  on  $x_j$  is given, two cases may arise:

$$x_j^{\max} \geq m_j \text{ or } x_j^{\max} < m_j.$$

The first case reflects status quo, the upper bound remains as  $m_j$ . The second case means that the given upper bound on  $x_j$  is non-active and can be replaced simply by  $x_j^{\max}$ . Solving sub-LP problems **MaxLP<sub>j</sub>** for all  $j$  yields active upper bounds for all  $x_j$  variables whether or not the upper bounds are initially specified for the problem **P**.

### Active Lower Bounds

Now consider another set of sub-LP problems:

$$\begin{aligned} \text{MinLP}_j: \quad & \text{minimize } Z = x_j \\ \text{s.t.} \quad & \sum_{j=1}^n a_{ij} x_j = b_i && \text{for } i = 1, 2, \dots, m \\ & x_j \geq 0 && \text{for } j = 1, 2, \dots, n \end{aligned}$$

Let  $x_j^{\min}$  denote the optimal solution of problem MinLP<sub>j</sub>. Again the case  $x_j^{\min} = 0$  reflects status quo. If  $x_j^{\min} > 0$ , one can replace the lower bound on  $x_j$  as  $x_j^{\min}$ , thus achieving an active lower bound.

### The FCP Heuristic Method

*Step 1:* Formulate and solve sub-LP problems **MaxLP<sub>j</sub>** and **MinLP<sub>j</sub>** to determine active lower and upper bounds,  $x_j^{\min}$  and  $x_j^{\max}$ , for  $x_j, j = 1, \dots, n$ . Set  $m_j = x_j^{\max}$  for all  $j$ .

*Step 2:* Extract all, say  $l$  ( $\leq m$ ), fixed costs  $f_j$  corresponding to  $x_j$  with lower bound  $x_j^{\min} > 0$ .

Step 3: Identify  $\Delta =$  the smallest remaining  $f_j$ , say  $f_p$ .

Step 4: Extract fixed cost  $(m - l) \Delta$  corresponding to the remaining number of basic variables.

Step 5: Formulate LP problem  $\mathbf{P}'$  with  $C_j = c_j + f_j/m_j$ .

Step 6: Solve problem  $\mathbf{P}'$  using any LP software and record solution  $\{x'_{jj}\}$ .

Step 7: Determine  $y'_j$  values as outlined in Remark 2.

Step 8: Stop. Record the solution for Problem  $\mathbf{P}$  as  $\{x'_j, y'_j\}$ .

### A NUMERICAL EXAMPLE

To explain the FCP heuristic method the following example is presented:

**P:** Minimize  $Z = 2x_1 + x_2 + 2x_3 + x_4 + 2x_5 + 5y_1 + 10y_2 + 10y_3 + 7y_4 + 8y_5$

$$s.t. \quad 8x_1 + 5x_2 + 6x_3 + 2x_4 + 3x_5 = 60$$

$$4x_1 + 4x_2 + 3x_3 + x_4 + 2x_5 = 35$$

$$2x_1 + 3x_2 + x_3 + 2x_4 + 3x_5 = 20$$

$$x_j \geq 0 \quad \text{for } j = 1, 2, \dots, 5$$

$$y_j = 0 \quad \text{if } x_j = 0$$

$$y_j = 1 \quad \text{if } x_j > 0$$

Step 1: The sub-LP problems yield the following bounds

$$0 \leq x_1 \leq 4.1667$$

$$2.8125 \leq x_2 \leq 3.3334$$

$$1.6667 \leq x_3 \leq 6.8750$$

$$0 \leq x_4 \leq 1.6667$$

$$0 \leq x_5 \leq 1.5625$$

Step 2: Extract the fixed charges for the “always more than zero” variables  $x_2$  and  $x_3$ .  $l = 2$  here. The objective function is revised as

$$\text{Min } Z = 10 + 10 + 2x_1 + x_2 + 2x_3 + x_4 + 2x_5 + 5y_1 + 7y_4 + 8y_5$$

Step 3:  $\Delta = f_1 = 5$ .

Step 4: The number of basic variables,  $m$ , is equal to 3. Since two basic variables already have been identified with  $x_j > 0$ , only one more basic variable needs to be determined,  $(m - l) = 1$ . Therefore, only one value of 5 will be extracted (and subtracted from the  $f_j$  values), resulting in the objective function of the given FCP as

$$\begin{aligned} \text{min } Z &= 20 + 5 + 2x_1 + x_2 + 2x_3 + x_4 + 2x_5 + (5-5)y_1 + (7-5)y_4 + (8-5)y_5 \\ \text{or } \text{min } Z &= 25 + 2x_1 + x_2 + 2x_3 + x_4 + 2x_5 + 2y_4 + 3y_5 \end{aligned}$$

Step 5: The modified objective function using Balinski transformation is as follows

$$Z = 25 + 2x_1 + x_2 + 2x_3 + (1 + 2/1.6667)x_4 + (2 + 3/1.5625)x_5$$

yielding the following LP problem,

$$\begin{aligned} \mathbf{P}' : \quad & \text{Min } Z = 25 + 2x_1 + x_2 + 2x_3 + 2.20x_4 + 3.92x_5 \\ & \text{s.t.} \quad \begin{aligned} 8x_1 + 5x_2 + 6x_3 + 2x_4 + 3x_5 &= 60 \\ 4x_1 + 4x_2 + 3x_3 + x_4 + 2x_5 &= 35 \\ 2x_1 + 3x_2 + x_3 + 2x_4 + 3x_5 &= 20 \\ x_j \geq 0 &\quad \text{for } j = 1, 2, \dots, 5 \end{aligned} \end{aligned}$$

*Step 6:* A solution to problem  $\mathbf{P}'$  using LINDO is as follows:

$$x_1 = 4.1667, x_2 = 3.3333, x_3 = 1.6667, x_4 = 0, \text{ and } x_5 = 0 \text{ with } Z(\mathbf{P}') = 40.$$

*Step 7:* Set  $y_1 = y_2 = y_3 = 1$ .

*Step 8:* The value of the matching FCP objective function,  $Z^*(\mathbf{P})$ , is

$$Z = 2(4.1667) + 3.3333 + 2(1.6667) + 5 + 10 + 10 = 40$$

Since the optimal values of the relaxed integer and regular fixed charge functions are the same, Note 3 implies that the identified solution is a global minimum.

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## **AN ASSIGNMENT MODEL FOR THE INTERIM HOUSING OF DISASTER VICTIMS**

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### **ABSTRACT**

The Northridge earthquake of 1994 displaced almost 10,000 families and destroyed major transportation infrastructure within Southern California, and Hurricane Katrina created the largest national housing crisis since the Dust Bowl of 1930, destroying over 300,000 homes and leaving over one million people seeking shelter. Arranging housing for disaster victims becomes more challenging as they are displaced for a longer period of time due to increases in costs, government involvement, and expectations of the victims. In early 2009, FEMA released the first-ever National Disaster Housing Strategy which calls for improved planning and outlines the key principles and policies guiding disaster sheltering, interim housing, and restoration of permanent housing. While all three housing problems are very difficult, the provision of adequate temporary or interim housing is perhaps the most challenging. A few researchers have addressed the issue of optimal allocation of temporary housing, but have focused primarily on the first part of the problem which focuses on the selection of adequate capacity from among available interim housing alternatives. The second part of the problem, which consists of the actual assignment of families to the temporary housing units selected in phase one such that educational, healthcare, and socio-economic needs are met, has not yet been addressed. We propose a model for assigning families to housing units which addresses these needs. We use a prototypical example to illustrate the model and to discuss possible modes of analysis and computational issues.

### **INTRODUCTION**

Natural disasters such as hurricanes, earthquakes, fires, floods, and tsunamis, and man-made disasters such as terrorists' attacks, have the potential to disrupt lives and displace families in enormous numbers. When homes are destroyed and families are displaced, providing shelter and housing is essentially a three-phase process. First, short-term emergency shelters must be located to provide safe space, food, and emergency medical care for the displaced families. These shelters may also serve as processing centers where information can be gathered about the families and their immediate and longer term needs. Once the sheltering phase is complete, which could last for a few days up to a few weeks, families are sometimes able to return home if the disaster damage is minimal and their previous homes are structurally and environmentally safe. However, this is often not the case. Disasters, especially large-scale events, commonly cause lasting structural and environmental damage to many homes and business, in which case families may be displaced for much longer periods of time. In the case of Hurricane Katrina, more than four years after the storm made landfall, many families are still unable to return home.

In this situation, we enter the second phase of the problem, providing interim or temporary housing. Although interim housing may last for several years, the goal of disaster relief planners is to limit the length of this phase as much as possible in order to minimize the adverse effects which families experience when separated from their socio-economic, medical, and educational support structures. If this interim period lasts too long or involves moving families too far from their previous neighborhood, families may never return to rebuild their old neighborhoods because of broken social ties or a general feeling of not belonging. The goal of interim housing is to provide as normal a life as possible until families can return to their homes or to other permanent housing, which FEMA identifies as the focus of the third phase. While all three phases of this housing problem are very difficult, the provision of adequate temporary or interim housing is perhaps the most challenging.

In early 2009, The Federal Emergency Management Authority (FEMA) published its National Disaster Housing Strategy which outlines their guidelines for planning and providing housing in all three phases [6]. Their report states “the needs and expectations of disaster victims in interim housing are greater than those in shelters, and our experience has taught us the importance of addressing these issues early in disaster response and throughout the recovery process.” They also affirm that “housing is the connector to how we live our lives and interact with the social networks within our communities. While interim housing cannot replicate a household’s pre-disaster conditions, it can be planned to integrate delivery of essential support or ‘wrap-around’ services, such as referrals for mental health, emotional, and spiritual support; job placement; childcare; social services; and other resources that can help make temporary housing viable.”

Researchers have long understood the importance of socio-economic impacts on displaced families [1, 7, 8]. When families are forced to live isolated from their familiar surroundings and friends, they may experience emotional difficulties and broken social ties which could ultimately lead to a reluctance to return and rebuild the former community. El-Anwar and El-Rayes [1] discussed the importance in this regard of minimizing the distance between the displaced family’s preferred location and its assigned temporary housing location. Other factors which affect the level of socioeconomic disruption include the capacity of temporary housing locations to support the economical, medical, educational, and safety needs of displaced families [2, 9, 10].

While many researchers have explored these effects, little attention has been given to quantifiable methods for assigning families which consider these factors. In a series of three studies, El-Anwar, et al. develop a model, and eventually an automated system, for identifying desirable housing alternatives, which have sufficient capacity, endeavoring to keep families close to their roots, ensuring safety, and minimizing environmental impact [2, 3, 4]. While their research is a major step forward, they do not suggest any mechanism for actually assigning families to the identified housing alternatives. Although identifying a pool of adequate housing capacity is a good first step, without a mechanism for matching families with alternatives, it is likely that many families will either end up in an area not of their choosing or fail to have the necessary healthcare and educational support services, which allow them to function properly. The only housing matching mechanism we are aware of is the FEMA Housing Portal [5] which allows web users to search a database of offered temporary housing listings. However, FEMA’s mechanism does not provide any information on nearby availability of hospitals and schools, nor does it allow planners to balance the needs of numerous displaced families. Such a first-come, first-served approach would likely be overwhelmed in the face of a large disaster.

The purpose of this paper is to suggest a model for making specific family assignments to interim housing alternatives. First, we present the details of the model. Next, we illustrate the computational aspects through a small example. Finally, we discuss limitations and possible future directions for this area of research.

### THE INTERIM HOUSING ASSIGNMENT MODEL

The interim housing model is designed to minimize the total distance from a family's preferred neighborhood and the needed support services across all displaced families. Consider the following definitions:

#### Variables

$X_{ij}$  = assignment of family  $i$  to housing alternative  $j$  (1 = yes, 0 = no)

#### Parameters

$F_j$  = maximum number of families to be allocated to housing alternative  $j$

$A_i$  = area of preference for family  $i$

$P_{ij}$  = preference matrix of family  $i$  for alternative  $j$  based on whether housing alternative  $j$  is in preferred area (1 = prefer, 0 = do not prefer)

$D_{A_{ij}}$  = distance from area  $A_i$  to alternative  $j$

$H_{jt}$  = distance to healthcare facility type  $t$  from alternative  $j$  ( $t = 1$  for hospital,  $t = 2$  for eldercare,  $t = 3$  for clinic)

$E_{jk}$  = distance to educational facility type  $k$  from alternative  $j$  ( $k = 1$  for elementary school,  $k = 2$  for middle school,  $k = 3$  for high school)

$HN_{it}$  = healthcare needs matrix (1 indicates a need in family  $i$  for healthcare type  $t$ , 0 indicates no need)

$EN_{ik}$  = educational needs matrix (1 indicates a need in family  $i$  for educational service type  $k$ , 0 indicates no need)

$W_f$  = relative weight on the importance of factor  $f$  ( $f = 1$  for socioeconomic area,  $f = 2$  for healthcare services,  $f = 3$  for educational services)

We now define the housing assignment model as follows:

$$\begin{aligned} \text{Min } Z = & W_1 \sum_i \sum_j (1 - P_{ij}) D_{A_{ij}} X_{ij} + W_2 \sum_i \sum_j \sum_t H_{jt} HN_{it} X_{ij} \\ & + W_3 \sum_i \sum_j \sum_k E_{jk} EN_{ik} X_{ij} \end{aligned} \quad (1)$$

$$\sum_i X_{ij} \leq F_j \quad \text{for each } j \quad (2)$$

$$\sum_j X_{ij} = 1 \quad \text{for each } i \quad (3)$$

$$X_{ij} = (1,0) \quad \text{for all } i, j \quad (4)$$

The first term of the objective function calculates the total distance from all assigned families to their preferred area. When considering any assignment  $X_{ij}$  of a family  $i$  to an area  $j$ , if the  $ij$  entry in the location preference matrix  $P_{ij}$  is a 1 meaning a preferred assignment, then the term  $(1-P_{ij})$  will be 0 and the resulting distance to that families preferred area will be 0. If the  $P_{ij}$  entry is 0 meaning that the considered assignment is not in the preferred area, then the distance  $D_{A_{ij}}$  from preferred area  $A_i$  to housing alternative  $j$  will be added to the sum. The second term of the objective function represents the total distance from assignment alternatives to necessary healthcare services. For any considered assignment, the healthcare needs matrix indicates the need of a particular healthcare service by a family with the presence of a 1 (families may have multiple healthcare needs and thus have 1's in several columns). By summing over healthcare needs types and multiplying by the distance from the considered housing alternative to the closest healthcare facility of that type, we obtain the total travel distance by all families to receive the types of healthcare they need. The third term is identical to the second except that it deals with educational needs. Families may have school-age children in several age groups and will certainly want to send them to an appropriate school without excessive travel. Finally, each term in the objective function may be weighted differently. The  $W_i$  allow for a penalty to be applied to any category which is deemed to be of greater importance. Using a weighted objective function is acceptable because the entire objective function is in the same units (miles). The default weights would, of course, be 1.

The constraints for each of the  $j$  housing alternatives (equation 2) will assure that no more than  $F_j$  families are assigned to alternative  $j$ . While not every family can be assigned to their preferred area, because of the planning considerations when the housing alternatives are identified, we are assured that there is adequate capacity and thus a feasible solution. The second constraint (equation 3) assures that each family is assigned to exactly one housing alternative. Finally, the last constraint (equation 4) assures that the assignment variables are treated as binary.

### AN INTERIM HOUSING EXAMPLE

To illustrate application of the interim housing assignment model, we present a hypothetical situation involving 50 families which must be assigned to 10 interim housing alternatives scattered across 6 areas of a city. First, matrices were constructed for each of the parameters discussed previously. We randomly generated the capacity (number of units) for each housing alternative, where each housing alternative is located within the city, the home neighborhood for each family, and the distance between areas of the city. From these, we were able to develop the preference matrix for each family for each alternative (assuming that families prefer to stay in their prior neighbor; this is not a necessary assumption). Next, we randomly generated the distances from housing alternatives to both healthcare and educational facilities (hospital, clinic, and eldercare for healthcare; grade school, middle school, and high school for education). Finally, we generated the healthcare and educational needs matrices. We assumed that 60% of families have needs for a hospital nearby, 30% have clinic needs, and 10% have eldercare needs. We also assumed that the chance of any family having a grade school, middle school, or high school student is 25% (note that any family can have multiple healthcare and/or educational needs, such as having a grade school and a middle school student and an elderly parent in need of eldercare). In a real disaster, this information would be collected during the sheltering phase by disaster case workers as displaced families are registered and easily entered into a readable database. This hypothetical dataset resulted in a model instance with 500 variables and 60

constraints. Because of the size of the model, we chose to use the CPLEX optimizer which is capable of solving very large problems. One of the major challenges in solving large-scale IP problems is the translation of data into the correct model format for solution. To assist in this process, we developed an Excel spreadsheet program using VBA to read the input parameters and matrices and generate formatted CPLEX code as a text file, which can then be read by and executed in CPLEX.

Table 1 presents the results for several test runs of the hypothetical problem with different objective function weights. In the table, we represent each component of the objective function separately; M1 is the total distance of all families to their preferred area (if a family is housed in their preferred area, the distance is assumed to be 0), M2 is the total distance from all families to all of their needed healthcare services, and M3 is the total distance across all families to all of their needed educational services. Other columns further break down these distances into averages across those families which actually have needs. For example, for the first run with equal weights, of 50 families to be housed, 9 were “displaced” (housed in areas other than their preferred area). For these 9 families, the average distance to their preferred area is 21 miles with a min of 17 and a max of 27. This measure gives some indication of the distance displaced families will have to travel on a frequent basis if they are to maintain community ties with their friends, their church, etc. The last two columns in the table indicate the average distance to healthcare and educational needs for each instance of a family need.

The last three rows of the table demonstrate how weights can be used to prioritize social, healthcare, and educational needs. Note that the (10,1,1) row is not substantially different from the first row. This is because distance to preferred area for a displaced family is generally much larger than distances to healthcare and educational facilities (there are generally lots of schools), and so the default weights result in a good solution from the standpoint of displacement distance; it is not until we apply higher weights to healthcare or education that we are motivated to house people further away from their preferred area. This can often be very beneficial as disasters commonly reduce or limit individual’s means of transportation and increase their stress level and the resulting need for healthcare. For the (1,10,1) case, in order to reduce the average distance to available healthcare from 9.11 to 6.98 miles, we must displace 9 additional families (18 total) with an average distance of 29.8 miles. The (1,1,10) case which places the highest weight on locating families near their educational needs results in a similar behavior, but the number of displaced families is not as extreme as is the case for healthcare.

**TABLE 1. RESULTS FOR THE TEST PROBLEMS**

(W1,W2,W3)	M1	M2	M3	Displaced Families	Dist to Preferred Area			Ave DtoH	Ave DtoE
					Ave	Min	Max		
(1,1,1)	189	410	272	9	21	17	27	9.11	5.67
(10,1,1)	187	408	279	9	20.77	17	27	9.07	5.81
(1,10,1)	536	314	281	18	29.8	17	39	6.98	5.85
(1,1,10)	278	414	249	11	25.3	17	39	9.2	5.19

\* M1, M2, and M3 are the mileages from the three components of the objective function  
 Displaced families are families housed outside of their preferred area  
 DtoH is distance to the nearest appropriate healthcare facility  
 DtoE is distance to the nearest appropriate educational facility



## CONCLUSIONS

Interim housing of disaster victims is an enormous problem which is only beginning to be studied. While others have suggested mechanisms for identifying safe and adequate interim housing alternatives, little has been done to address the problem of actually assigning families to available alternatives. We develop a model for assigning families to housing alternatives that takes into account health, educational, and social needs of displaced families and the ability of possible housing alternatives to meet those needs. We then demonstrate its application with a small hypothetical example. While the results of the example are based on hypothetical data, it serves to illustrate the type of analysis that can be performed. As a direction for future research, we are attempting to secure data from a recent disaster for further testing of the model.

Also, we must acknowledge that real disasters will involve solving much larger problems. We are optimistic that CPLEX will be capable of solving them, as it has been used for problems with upwards of a million variables. For a large-scale disaster solution, an application with a familiar and easy to use interface as well as automatic code generating programs such as the prototype we developed here would be essential. Other directions for future research may include methods for decomposing large-scale problems into smaller ones, or using data pre-processing to reduce the dimensionality of the problem.

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**Do College Students Lack Basic Math Skills?**

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## **ABSTRACT**

Faculty members across college campuses complain that students lack the most basic of math skills. A study was conducted at a southern university in sophomore level production classes to assess skills such as the order of arithmetic operations, decimal and percent conversion, solving of algebraic expressions, and evaluation of formulas. In this paper, the study was replicated using business statistics and quantitative analysis classes at a southeastern university. Data analyses compared students' test results from the different classes at the two universities and identified surprising patterns across classes, universities, and professors.

## **INTRODUCTION**

After listening to colleagues and observing students over many years, Jones (2009) noted that students appear to have forgotten how to apply basic math skills. Researcher Abigail James (2007) speculates that these skills might not be forgotten but rather that they were never mastered. She believes most students finish high school without the ability to tackle multi-step problems or understand how to apply algebra, capabilities that could be the casualty of school systems focusing on preparing students for mandatory standardized tests. Whatever the reason, research by the Department of Higher Education in Arkansas found in 2008 that 42.8% of its state's college freshmen needed remedial math (Howell, 2009). These basic math skills are rooted in algebra, a branch of mathematics that Tolar (2007) describes as a 'gatekeeper' to educational and economic opportunities. If this is true, does this lack of basic skills impede the progress of students in degree programs such as business which include classes that are quantitative in nature?

Research studies have found that without grasping basic math concepts, students can still answer questions correctly and perform well on tests (Garfield and Ben-Zvi, 2007). This may be misleading. Johnson and Kuennen (2006) theorize that deficiencies in basic math skills

influence one's ability to analyze, reason, and interpret data. Not all college courses require a proficiency in algebra, but many test students' aptitude in analyzing and reasoning. And while beginning statistics, which is required in business programs, is considered by some not to be mathematics (Johnson and Kuennen, 2006), math concepts are used in statistics and in other classes in various disciplines (Garfield and Ben-Zvi, 2007).

Mathematics' place in statistics is a controversial subject. Some experts feel it is the basis of statistics, others are concerned that math-phobia inhibits learning in statistics (Gordon, Petocz, and Reid, 2009). Either way, most students argue that statistics is dull and difficult and claim that little of the material is retained (Ben-Zvi and Garfield, 2004). Some go further and declare it was the worst class they took while in college (Ben-Zvi and Garfield, 2008). This may be explained by Ben-Zvi and Garfield's research (2004) which reveals that difficulties with underlying math concepts interferes in students' ability to grasp statistical concepts. Yet a solid foundation in statistics is viewed as critical in many degree programs (Reid and Mason, 2008).

As students continue to question the importance of math, faculty understand that in this age of information the ability to deal with data is critical. Having the capacity to gain information can hinge on students' grasp of fundamental concepts and the ability to interpret those tools (Everson, Zieffler, and Garfield 2008). The capability of evaluating claims and creating evidence-based arguments are important skills for everyone (Watson, 2006). We are surrounded by data used to lend credibility to advertisements, arguments, and proposals. Math, especially statistics, allows students to react intelligently to the world around them (Ben-Zvi and Garfield, 2008).

As business faculty continue to try to educate students and prepare them for life after college, it can be argued that math skills are an important determinant of student success in

elementary statistics, even in instances where computers assist in calculations. Johnson and Kuennen (2006) found these basic skills to be more indicative of success in statistics than ACT math scores or exposure to calculus. Furthermore, Truell and Woosley (2008) found the grade a student earns in statistics is the single greatest predictor in whether or not a business student finishes his/her degree program. If these math skills are critical skills for success in statistics and if students are entering college without them, faculty need to understand that these deficiencies exist. This knowledge will enable faculty to be more effective in creating better lessons and helping students succeed (James, 2007).

## **BACKGROUND**

In an attempt to ascertain students' basic math skills, a faculty member at a university in the south that is classified as a Doctoral Research University and boasts over 19,000 students as well as an accredited business program, created a set of math problems (see Appendix 1). These problems incorporated operations of arithmetic as well as the hierarchy of math rule, decimal and percent conversions, algebra, and numerical substitution into and evaluation of formulas. Skills needed to solve these problems were deemed to be within the ability of a student completing a 10<sup>th</sup> grade math assignment. The problem set was administered unannounced several weeks into the semester in a sophomore level production class, which is a required core class. The course has the following prerequisites:

- Finite Math (topics include counting problems, probability, tabular and graphical procedures, measures of central tendency and dispersion, random variables, expected values, binomial distributions, and normal distributions)
- Business Foundations (an overview of business)
- Legal Environment of Business
- Data Analysis and Interpretation (builds upon data analysis concepts from Finite Math, topics include research design, estimation, hypothesis testing, and regression and correlation analysis)
- Principles of Microeconomics

The students were given approximately 10 minutes to finish the problems and were not allowed to use calculators. A total of 91 students completed the skills test. Only 13% of the students solved all 15 problems correctly. The mean number correct was 11.5 (77%) and the median number correct was 12 (80%). This was not deemed to be satisfactory given that the skills tested were very basic math skills - ones that should be mastered by 10<sup>th</sup> grade (Jones, 2009).

Faculty members from a university in the southeast which is also classified as a Doctoral Research University with roughly the same size student body and an accredited business program were interested in the study. One of the faculty members teaches business statistics, an introductory course that covers the concepts and techniques concerning exploratory data analysis, frequency distributions, central tendency and variation, probability, sampling, inference, regression, and correlation. This course has the following prerequisites:

- Calculus I or Business Calculus (topics include the fundamental elements of differential and integral calculus of algebraic, logarithmic and exponential functions with a brief review of algebraic principles, limits, derivatives and integrals)
- Advanced Business Applications (experience in creating advanced business applications using spreadsheet and database management system tools)
- Financial Accounting
- Global Economics
- Introduction to Business (an overview of business)
- Legal Environment of Business

Students generally are able to satisfy the prerequisites for this class the second semester of their sophomore year or at the beginning of their junior year of college. While this course is an Excel intensive class, students who have not mastered basic math skills cannot create appropriate formulas for their worksheets. Using a computer versus a calculator versus manual computations cannot resolve issues with the hierarchy of math rule.

A second faculty member from this university agreed to administer the problem set to students in her quantitative analysis class. This class is a required junior core course that focuses on scientific decision-making methods for modern day managers, including such topics as linear programming, regression, forecasting, project management, and decision analysis. Business statistics serves as the prerequisite for this course, delaying this class until students are juniors or seniors.

### **METHODOLOGY**

In 2009, the problem set was administered to classes in both business statistics and quantitative analysis. In all cases, the problem set was given unannounced to the students within the first two weeks of the semester at the beginning of class. Students were given roughly 10 minutes to answer the questions and were not allowed use of a calculator or a computer. A total of 230 statistics students (2 sections during spring semester, 2 sections summer, and 1 section fall) and 181 quant students (2 sections summer and 3 sections fall) completed the problem set.

### **DATA ANALYSIS**

The 15 problems were marked as correct or incorrect, with no partial credit given. The results were compared problem by problem for the three groups (production versus statistics versus quantitative analysis). Additionally, the overall mean and median percentage of correct answers were compared along discipline lines. The overall mean percentage correct for the three groups was tested for significance using ANOVA.

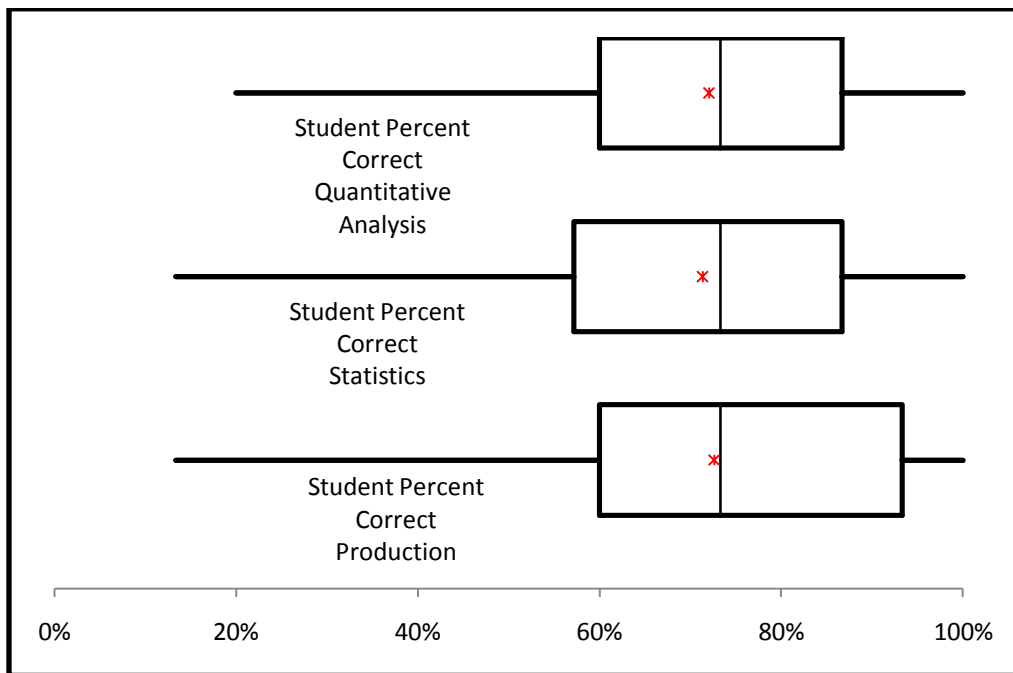
### **RESULTS**

Using the percent correct responses for each of the students enrolled in the three different subjects, box plots were created to illustrate the difference in performance of the three groups of



students<sup>1</sup> (see Figure 1). The mean percent correct responses among the production students was 72.6% (with a standard deviation of .207), among the statistics students was 71.4% (with a standard deviation of .193) and among the quantitative analysis students was 72.0% (with a standard deviation of .191).

**Figure 1**  
**Box Plot Comparing Overall Mean Percent Correct**



The mean percent correct responses as well as the standard deviations of the three disciplines appeared to have no significant difference. ANOVA was employed to statistically determine whether or not the mean percent correct responses of the three disciplines were equal (see Table 1). The ANOVA test generated an F-ratio of .2099 and a p-value of .8107. The p-value supported the conviction of the researchers that there was no significant difference between the mean performances of students by discipline.

<sup>1</sup> Additional data for the production students were obtained since the original study.

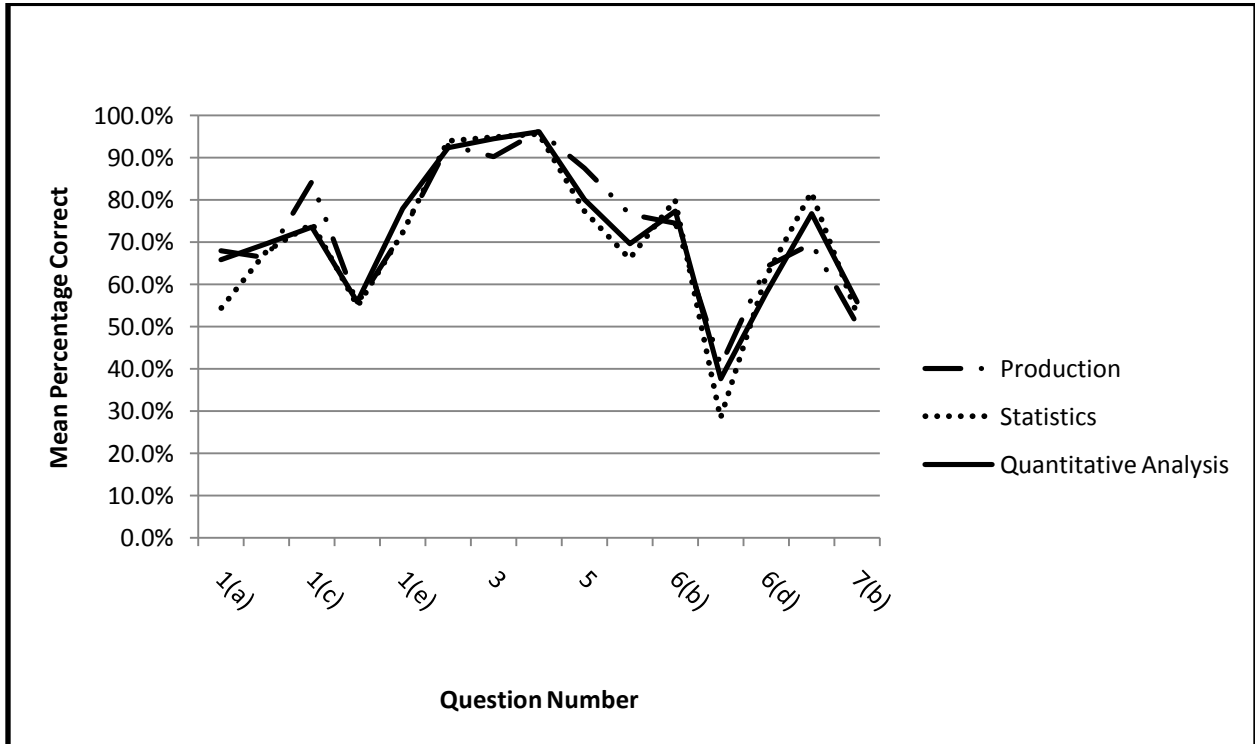
**Table 1**  
**ANOVA Results**

	Student Percent Correct(Production)	Student Percent Correct(Statistics)	Student Percent Correct(Quantitative Analysis)		
<b>Sample Size</b>	184	230	181		
<b>Sample Mean</b>	0.7261	0.7135	0.7204		
<b>Sample Std Dev</b>	0.2074	0.1933	0.1910		
<b>Sample Variance</b>	0.0430	0.0374	0.0365		
<b>Pooling Weight</b>	0.3091	0.3868	0.3041		
<b>OneWay ANOVA Table</b>	<b>Sum of Squares</b>	<b>Degrees of Freedom</b>	<b>Mean Squares</b>	<b>F-ratio</b>	<b>p-value</b>
<b>Between Variation</b>	0.0163	2	0.0082	0.2099	0.8107
<b>Within Variation</b>	22.9997	592	0.0389		
<b>Total Variation</b>	23.0160	594			

After determining that there was no significant difference in the mean percent correct among disciplines, the focus of the analysis moved to performance on the individual problems. The first five problems on the test addressed the order of operations (see Appendix 1). This was a weak area in terms of correct responses. The most missed of the five was problem #1 part d (range of 54.8% to 55.8% correct). Problems #1 parts a and b both had below 70% correct (range of 54.3% to 69.6% correct). The other two problems had a greater percent correct however, one (part c) had its order of operation the same as the order of math processes from left to right. The other (part e) was aided by the use of parentheses.

On the average, only 35.0% (range of 28.3% to 40.8%) could correctly solve problem 6 part c. This problem did require students to solve a square root. Square root was also needed in problem 7 part b (50.5% to 55.8% correct). The patterns that were discovered went across disciplines, across faculty, across universities. When plotting the percentage correct by question, students struggled on the same concepts (see Figure 2).

**Figure 2**  
**Mean Percent Correct by Question by Discipline**



### CONCLUSIONS

The purpose of this research was to replicate a prior study and report preliminary analyses. It is the belief of the authors that the students' struggle with basic math skills is not isolated but rather widespread. This belief is based on personal observations as well as grumblings among faculty across the campus. At a time when many universities are boasting higher SAT scores, students still struggle with basic math operations.

This study was conducted at two similar universities in three different business support classes, i.e., classes that are designed to supplement students' basic skills and are part of the business core. The results were startling. For the faculty administering the problem set, difficulties with basic math skills were found to be consistent from classroom to classroom. The areas of difficulty for the students were the same not only on two different college campuses, but

in classes of different levels (sophomore versus junior versus senior) and with different prerequisites. In fact, student performance did not improve in basic math skills as students moved from business statistics to quantitative analysis, with statistics serving as a prerequisite class for quantitative analysis.

Many students are exhibiting a lack of basic math skills. This places them at a disadvantage in learning material that is dependent upon these concepts. It may also influence their ability to analyze, reason, and interpret data, making them weak in classes that require analyzing and reasoning (Johnson and Kuennen, 2006). Lack of skills and fear of math contribute to high drop rates colleges experience in math and math-based classes. It may also be a factor in attrition. Truell and Woosley (2008) found the grade a student earns in statistics is the single greatest predictor in whether or not a business student finishes his/her degree program. If these are critical skills and if students are entering college without them, faculty need to understand that these deficiencies exist and must be able to help students overcome these areas of weakness. This knowledge will in the end enable faculty to be more effective in creating better lessons and helping students succeed (James, 2007).

In future research, the authors plan to compare test scores by gender in an effort to see if basic math skills are more likely to be retained by one sex over the other. Test outcomes will also be used to ascertain whether or not the final grade a student receives in business statistics, quantitative analysis, or production can be predicted using performance on the problem set.

## APPENDIX 1

1. Perform the indicated operations for each of the following expressions without using a calculator.

(a)  $26 + 34 / 2 =$

(b)  $29 - 37 - 18 =$

(c)  $3 / 2 + 1 =$

(d)  $6 - 2 \times 14 =$

(e)  $3 + 4 (20 - 17) =$

2. Express .01 as a percentage.
3. Express  $3/4$  as a percentage.
4. Express 3 percent as a decimal.
5. 2 is what percentage of 8?
6. Solve each of the following expressions for x.

(a)  $\frac{39}{3x} = 3$

(b)  $11x + 3000 = 7x + 8000$

(c)  $3\sqrt{x} = 45$

(d)  $Z = \frac{X - M}{S}$

7. Evaluate each of the following formulas without using a calculator assuming that  $A = 108$ ,  $C = -4$ ,  $N = 6$ , and  $S = 312$ .

(a)  $M = \frac{A}{N} - C$

(b)  $X = \sqrt{\frac{S}{N} - C^2}$

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# The FED's Effort to Avert Great Depression II: A Comparative Analysis

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## Abstract

Given the sequence of events supporting the premise that the Great Depression may have influenced the conduct of Federal Reserve monetary policy during the recent financial crisis, this paper examines the short term actions of the central bank to minimize the impact of the crisis on aggregate output and the unemployment rate. Specifically, this study focuses on comparative quarterly data from time periods 1930-1932 and 2007-2009. In general, Federal Reserve initiates corrective action when the GDP, unemployment and inflation are out of kilter. In this paper a simple model developed by Brainard (1967) is utilized to analyze the effectiveness of FED policy actions. This study hopes to show the comparative differences between the two time periods that yield an approximate measure of the FED's success in achieving the welfare maximizing policy goals of reducing unemployment, increasing GDP and maintaining price stability.

## Introduction

How to conduct monetary policy has been a long running debate among central bankers and financial economists who often argue the virtues of “**rules versus discretionary**” policy. Even though the contention for a monetary rule, which is based on a preset target for money growth or the inflation rate, there are difficulties on exactly how to normalize policy to the FED's objective. **Discretionary policy**, in contrast to monetary rules, is based on whether FED policy should be subject to change at the discretion of the FED's policy arm. These financial economists argue that “rules” unnecessarily hinder the FED actions and does not allow it to respond to current conditions (Klein, 2002). More recent developments in the debate over discretionary policy are concerned with the idea that such policy plays on people's expectations, which also have an impact on the underlying rate of inflation. (Kydland & Prescott, 1977) in Klein (2002) were early contributors to the idea that **time inconsistencies** can occur when the FED's initial policy becomes sub-optimal since at its discretion it can be reversed, which affects

expectations and thus makes the initial policy less credible and less effective. If the discretionary policy outcome is poor as compared to rule policy, then perhaps arguments for monetary rule may be preferable since advocates for monetary rule would contend that the FED cannot manage people's expectations.

FED policy goals are to augment output (GDP), preserve low unemployment and retain a low rate of inflation. Ideally output would equal potential output and the rate of unemployment would equal the natural rate. Most importantly, when either fails to maintain their ideal levels, society can suffer considerable loss. The same reasoning can be applied to the rate of inflation, which can also impose significant costs on society especially when the ideal rate deviates from the actual rate. In this paper, we assume that the FED arrives at an **"optimal" policy** for any given time utilizing a loss function, which measures the economy's GDP loss from having it or inflation differ from their ideal levels. The **loss or objective function** as it is labeled can be approached by asking what level of GDP would be necessary if the economy was operating efficiently based on the premise that recession does not exist and never will occur. Thus, if output equates to full employment, then the economy is operating efficiently and GDP has reached potential (Croushore, 2007) Any further attempts at increasing output beyond full production, full employment would be fruitless since inflation would result. However, the FED faces a dilemma in that it must contend with crafting an optimal policy particular to the conflicts imposed by short term versus long term policy actions and impacts. Thus, the FED must make choices about the **tradeoffs** between the long and short term.

Yetman (2002) contends that effective conduct of monetary policy is made difficult by uncertainty. The economic dimensions of uncertainty including uncertainty about shocks, model parameters, data, and the "correct" model of the economy itself are illusive. Generally, over the business cycle, the Federal Reserve's role in stabilizing the economy is influenced by three key macroeconomic indicators, including output (GDP), the unemployment rate and the inflation rate (price stability/interest rate stabilization). When these indicators differ from the "just right" or "optimal", through stabilization policy the Federal Reserve can invoke a variety of policy tools. Accordingly, the FED utilizes expansionary policy when it attempts to lift GDP so that it equates with potential GDP; the ideal inflation rate; and, so that the unemployment rate is comparable with the natural rate of unemployment. Since the inflation rate tends to move higher over the longer term, the tradeoff between it and the unemployment rate can be quite different in the short term as opposed to the long term. Therefore, having a thoughtful understanding of the goals of monetary policy is essential since their outcomes reflect how policymakers may tradeoff different goals as **economic shocks** emerge (Croushore, 2007).

Consider the 2007 U.S. financial crisis, when as demand weakened there was an accompanying recession. In this context, the Fed can temporarily stimulate the economy and help push GDP up toward its long-run level by reducing interest rates. In recent a report by the Federal Reserve Bank of San Francisco (2009), it revealed that the Federal Reserve's policy making body, the Federal Open Market Committee (FOMC), lowered the benchmark short-term interest rate to close to zero. This stabilizing effort is an attempt to the smooth out the highs and lows in GDP and employment so that they stabilize around their long-run growth paths. As such, the FED's pursuit of an "optimal" policy in a recessionary economy is a difficult calculation. Nonetheless, successful implementation of expansionary policy is essential in view of the fact that a



miscalculation can have significant consequences for society (Croushore, 2007). In fact, a widely held view in policy and academic circles is centered on the FED's effort at monetary policy actions and the success of that effort to affect long term GDP and employment. For instance, in the face of the 2007 global economic slowdown, the Fed has employed a long series of interest-rate reductions prompting many to pronounce that the FED has no proof that such a policy action will actually avert a global slowdown and may in fact have long term unintended consequences.

## Theoretical Basis

### An Analysis of Brainard's Uncertainty Concept

For the most part, the voluminous literature concerning the FED's objective or loss function has focused on uncertainty, which has been devoted to robust rules that function well even when policymakers have imperfect information or knowledge that provides false premise as to the real structural equations that typify the economy. Concerning William Brainard's (1967) classic work, which investigates monetary policy under bounded uncertainty, has been extended by many others including the research of Kendrick (1982), Balvers & Cosimano (1994) referenced in Levin, Wieland and Williams (2002). Fischer & Copper (1973) show that in a dynamic model with uncertainty, certainty equivalence policy is not optimal and that increased uncertainty argues for more vigilant policy. Starz (2005) refers to Henderson & Turnovsky's (1972) work which portrays a model with quadratic adjustment costs for changes in the policy leading to a partial adjustment model in which increased uncertainty slows the rate of adjustment. Also found in Starz (2005) is Chow's (1975) general analysis of dynamic systems under uncertainty.

Clouse, Henderson, Orphanides, Small, & Tinsley (2000) raise the issue of currently low levels of inflation both in the United States and abroad. These researchers assert that long term rates of inflation and levels of nominal interest rates can become so minimal that policy actions face the risk of becoming hindered in its attempts to lessen economic downturns. This scenario, they contend, can occur if monetary policy cannot fully offset an economic downturn because nominal short-term interest rates hit their lower bound of zero. As a consequence, any FED policy actions are made in the context of uncertainty. Significant here is expanded sustainable output (GDP) and employment, which are dependent on other factors including technology and household preferences for saving, risk, and work effort, which provide long run consistency.

Brainard's (1967) paper based on uncertainty is concerned with monetary policy actions that attempt to link some target such as inflation or an output target. Essentially, his prescription is one of **gradualism** or caution contending that under a variety of conditions, a policy action that confronts uncertainty concerning the economic environment should react less to information (since it is likely to miss the target) than a policy action that encompasses all relevant information regarding the environment. As such, his prescription suggests that if a policy action is made in the context of uncertainty; it would be carried out based upon exaggerated reactions to currently available information (Barlevy, 2009). Stated alternatively, Brainard's analysis suggests that parameter uncertainty leads to more cautious policy prescriptions.

Barro (1989) argues that targeting the nominal interest rate is a reasonable guide for monetary policy. He explains that expected real interest rates and output are exogenous with respect to

monetary variables, and the FED ends up influencing nominal interest rates by altering expected inflation. In this model FED policymakers can come arbitrarily close in each period to its (time-varying) target for the nominal interest rate, even while holding down the forecast variance of the price level. The latter objective pins down the extent of monetary accommodation to shifts in the demand for money and other shocks, thereby making conclusive the levels of money and prices at each date. Empirical evidence for the United States in the post-World War II period suggests that the model's predictions accord reasonably well with observed behavior for nominal interest rates, growth rates of the monetary base, and rates of inflation. Earlier periods, especially before World War I, provide an interesting contrast because interest-rate smoothing did not apply. The behavior of the monetary base and the price level at these times differed from the post-World War II experience in ways predicted by the theory.

According to Barlevy (2009) various economic models suggest that monetary policy can affect inflation, unemployment and output variables over the short run. Nonetheless, he says other factors beyond the control of FED policymakers can also influence these variables. Meeting the desired target will thus require the FED to intervene in a way that offsets changes in these factors. Brainard (1967) focused on the question of how this intervention should be conducted when FED policymakers are uncertain about the economic environment they face yet can assign probabilities to all possible scenarios. In spite of this, early applications of activist monetary policy vigorous and apparently contradicted the gradualist recommendation expressed by Brainard (1967). This implies that FED policymakers facing uncertainty should respond more aggressively to news that they are likely to miss their target than those policymakers facing no uncertainty explain Barlevy (2009).

However, as Barlevy (2009) points out, even though minimizing expected loss is a widely utilized criterion for choosing policy in some situations; it may be difficult for FED policymakers to assign expected losses to competing or multi- objective policy choices. Barlevy (2009) insists that this is sound reasoning given the difficulties in assigning expected losses to rare events that offer scant historical pattern by which to ascertain their precise likelihood of occurrence. For this reason, some economists have considered an alternative approach to monetary policy in the face of uncertainty, which does not require knowing the probability associated with all possible circumstances. Barlevy (2009) maintains that this approach is principally motivated by design intentions found in engineering systems controls. Similarly, he says policymakers must deal with the uncertainty about the systems they devise; that is how to account for such uncertainty in their models. Economic applications based on this approach are discussed in a recent book by Hansen and Sargent (2008) according to Barlevy (2009). Referred to as robust policies, this alternative approach favors and reflects policies that avoid large losses in all relevant settings regardless of likelihood of occurrence.

He insists that uncertainty about the precise quantitative effect of policy is endemic in economics. Starz's (2005) extends Brainard's work in a paper that incorporates a dynamic model to derive a partial adjustment model as the optimal response to shocks. In Brainard's (1967) classic paper, he explains that in a static model in the face of uncertainty optimal policy is relatively conservative. Levin & Williams (2003) paper analyzes the problem of parameter uncertainty utilizing micro models in which the FED's major goal is to maximize household welfare. And as such, has a loss function with weights that are directly related to the intrinsic

structural parameters of the model. According to the authors, in such a context, the FED faces uncertainty not only about the dynamic behavior of the economy, but also the degree of weight assigned to each of the variables that enter its loss function.

Shuetrum & Thompson (1999) argue that increased activism is primarily a consequence of uncertainty concerning the diligence of shocks to the economy. These authors contend that type of uncertainty cannot be incorporated into Brainard's static model approach. In addition, these researchers observed that model uncertainty can have important implications for policy especially when uncertainty about the model may make monetary authorities more conservative (in the sense that they determine the appropriate policy response ignoring uncertainty, "and then do less"). This conservative approach to policy was first made official by Brainard (1967). Invoking Blinder's views of Brainard conservatism principle "as extremely wise", Shuetrim and Thompson (1999) admit that the result is not robust. In fact, Shuetrim and Thompson (1999) for practical purposes, insist that this recommendation leaves two questions unanswered. The first is how much should policy be adjusted to account for model uncertainty? And second, is conservatism always the appropriate response?

To answer these questions, Shuetrim and Thompson (1999) generalizing the Brainard model (through a multi-period horizon and a multivariate model); develop a small data-consistent model of the Australian economy to illustrate the effect of parameter uncertainty on policy reaction. The authors find contrary to Brainard's conservatism result that parameter uncertainty can actually induce greater policy activism following various economic shocks. The increased activism is primarily an outcome of uncertainty concerning the resolution of **shocks** to the economy. In this case, Freedman of the Bank of Canada (2000) says we are faced with additive, multiplicative, data, and model uncertainty. Additive uncertainty comes from the projections of external and domestic demand and supply developments, or shocks.

Gregory's (1990) work provides insights into solving for the optimal rule for policy advice and comparing it to the optimal policy rule. His contention is that policy rules in practice are often criticized on the grounds that policy is made not by rule but through caution. Utilizing the similarities of Brainard (1967), which demonstrates that uncertainty about the economy makes optimal policy less activist, Gregory (1990) examines the difference between **optimal policy rule** and **optimal advice** that arises because the advisor has two conflicting goals. In his model, the uncertainty is not about the economy but about whether the advice will be followed. Gregory's (1990) attempts to illustrate that the advisor's uncertainty also makes the advisor less activist (in the sense that he/she recommends a policy that deviates less from what will be done if the advisor is ignored). Accordingly, unless such advice is always sought and followed, the optimal rule for policy advice generally lacks sufficient commonality as to the optimal policy rule. In this case, the problem for the advisor (who knows that his/her advice will only be followed with a certain probability), is the alternative of a passive monetary policy. As such, Gregory (1990) explains that the smaller the probability that the advice will be followed, the less active should be the advice and thus the smaller the recommended offset of aggregate demand shocks. Even if the probability of the advice being followed is close to zero, however, some non-negligible offset of **demand shocks** should be recommended, the author concludes.

### **Brainard's Conservatism Principle and the Modern Central Bank**

Blinder (1999) speaking at a European conference presented jointly by the European Central Bank and the University of Frankfurt, said that the focus of the FED needs revision and raised a multitude of issues on what it would take to be “**what it takes to be the very model of a modern major central bank**”. Interestingly, Brainard's (1967) "conservatism principle" is given a role in building this model. In all, Blinder revealed fifteen questions that a central bank would have to answer to become "what it takes to be the very modern central bank", one of which garners support for Brainard's (1967) position concerning monetary policy and certainty. Blinder's (1999) emphasis is on how both the questions and the answers differ from what people might have thought ten or twenty years ago. The questions were divided into three categories:

- Issues of institutional design (seven issues);
- Tactics for operating in the markets (four issues);
- Issues pertaining to the bank's model of the transmission mechanism (four issues).

The first seven issues are centered on how the FED should "set up shop". The first two arguments point to its loss function (what the weights should be) and should the FED target inflation? The third issue pertains to transparency and the FED's responsibility to be more so than in the past. Blinder says that rarely discussed is the question as to whether FED policy should be made by an individual or committee. Whether a central bank operating in a floating exchange rate regime should abandon foreign currency intervention as a policy tool (even though the exchange rate is an important part of the monetary transmission system is fifth issue put forth by Blinder (1999); that is it give up intervention altogether? The sixth issue concerns the monetary authority's responsibility to also regulate and supervise banks pointing out the United Kingdom has separated the functions. Blinder's next question asks do various (actual and initial) forms of electronic money present a threat to central banks. He discusses two distinct sorts of threats both of which arise from the possible erosion of the bank's monopoly over the issuance of the medium of exchange.

The next four issues deal with the operating tactics of the central bank, which begins with issue number eight. It concerns a broad question of strategy rather than a narrow deliberate one, which more specifically relates to the FED's early bullying approach to markets. This says Blinder is no longer the case since the FED is more likely than not to keep markets well informed. Although this may be the right thing to do (especially if the bank has conditioned market expectations properly), it is not always the case because financial economists and bankers believe that markets tend to go to extremes and overreact. Another important question that must be addressed according to Blinder (1999) is how should monetary policy adapt to the explosion of derivatives and bizarre financial instruments that central bankers never dreamed of a decade or two ago? Some of these markets are extremely liquid while others are not. As such, should the FED be operating in these markets or should it confine itself to open market operations? Issue ten, which is discussed above pertains to what Blinder calls the Brainard (1967) conservatism principle: the idea that multiplier uncertainty should make the central bank more conservative, in the sense of using its policy instrument less vigorously.

Blinder's treatise on Central Banking in Theory and Practice (1998), argues that while the "**conservatism principle**" is not very robust mathematically, intuitively he says in the real world it is generally or at least more wise than the mathematics will support. Conceding that his remark

seems to have touched off a fair amount of quite interesting academic work, which he says has been a surprise as to how little support Brainard's principle has received. In point of fact, he insists by now there are a number of examples in which multiplier uncertainty, in conjunction with something else, leads an optimizing central bank to vary its instrument more than it would under certainty. Granting that the Brainard result is indeed fragile, Blinder contends that new anti-Brainard results are both puzzling and troubling. According to Blinder, although his confidence in the conclusion has been shaken by recent research, his intuition is that Brainard was right in practice. In any case, he concludes, it is certainly an intellectual question that should engage modern central bankers.

In changing monetary policy, should the FED move interest rates by a small or large amount? This is issue number eleven in which Blinder points to Greenspan's tenor and his favoritism for small movements in interest rates. Blinder contends that an appropriate monetary policy (perhaps one that approximates a Taylor rule) is one that can remove the unit root from the inflation process. Again leaning toward Brainard's approach, Blinder (1999) says a more gradualist approach to monetary policy might make sense, which is something for a contemporary central banker to ponder. Blinder's last four questions are concerned with the FED's model of the economy. The first of these (issue twelve) is should the FED think of its overnight interest rate, not any monetary aggregate, as its principal policy instrument? Blinder insists that central banks should discontinue the focus on the textbook link (from bank reserves to bank lending to aggregate demand); Instead, a contemporary FED should think of the major linkages in the transmission system as proceeding from its policy rate to other interest rates and financial prices (such as longer-term interest rates, exchange rates, and stock market values) and from there on to aggregate demand. Blinder says that the  $M_s$  ( $M_1M_2M_3$ ) are byproducts of this process and have no gigantic inherent interest.

Issue thirteen deals with the so-called expectations theory of the term structure in that as Blinder puts it is dead wrong. His reasoning is based on the contention that long rates are horrible predictors of future short rates. As a fact well-known in academia, in the markets, and in central banking circles, Blinder (1999) says that its resolution remains a mystery. Given the importance of long-term interest rates to the monetary transmission system, this may be the single most important intellectual issue with which modern central bankers must struggle. The next issue is from an international perspective and is a closely-related paradox there. Uncovered interest parity ties current and expected future exchange rates to the interest-rate differential between any two countries. At least that is the theory; yet it fails miserably as a forecaster of future exchange rates according to Blinder (1999). As he puts it, everybody knows it; however, no one seems to know how to resolve it.

The last question posed by Blinder (1999) is how does a central bank conduct monetary policy in the absence of a reliable Phillips curve? For many years, it seemed that the FED, which gave it an important advantage over the other G7 central banks. However, this is not the case today says Blinder since it has been malfunctioning of late and is a serious handicap. In that there are long lags in monetary policy, it is generally agreed that the FED needs to conduct a "preemptive" monetary policy, which means moving on the root of inflation forecasts. Consequently, the disintegration of the Phillips curve leaves us without a trustworthy approach to anticipate the impacts of economic activity

## The FED's Loss Function

Since the current state of the economy is not known with certainty, the reactions of the economy to supply and demand shocks are difficult to quantify. With new shocks appearing on the horizon with unpredictable consistency, the communication conduits from policy tool to the objectives are complex and difficult to forecast. Nonetheless developing the FED's loss function algorithm involves establishing an output gap measure, an inflation gap and an unemployment gap measure. As Croushore (2007) illustrates in his book, it can be expressed mathematically by utilizing following equations:

GDP gap at time t = percentage deviation of output from potential

= [(actual-potential GDP) ÷ potential GDP] x 100%

$$\tilde{y}_t = \frac{y_t - y_t^*}{y_t^*} \times 100$$

The inflation gap is defined as the actual inflation rate minus the ideal rate can be expressed as shown below:

Inflation gap at time t = actual inflation rate – ideal inflation rate

$$\pi_{time\ t} = \pi_{actual} - \pi_{potential}$$

Similar to the measures above, the unemployment gap is equal to the unemployment rate minus the natural rate of unemployment, or:

Unemployment gap = unemployment minus – natural rate of unemployment

$$\tilde{u} = u - u_n$$

The FED's objective function adds the squared GDP gap to the squared inflation gap with a weight that determines the tradeoff between inflation and GDP, which is the equivalent of unemployment. In general, the FED's objective function can be expressed as follows:

Objective Function = Total Loss = sum over time of [GDP loss + (w x inflation loss)]

$$= \sum_{time} [\tilde{y}_t^2 + (w \times \tilde{\pi}_t^2)]$$

Brainard's (1967) fundamental framework, which is a static construction with a linear relationship between a target variable  $Y$  and policy instrument  $X$  can be expressed as follows:

$$= Y - bX$$

Policymakers face uncertainty vis-à-vis the sensitivity parameter  $b$ , which has a Gaussian prior (as the density function of the normal distribution which is a limiting probability distribution of complicated sums, according to the central limit theorem). In Brainard's (1967) framework, the objective function weight is known and fixed, and hence has no effect on the determination of optimal policy. In essence, Brainard (1967) illustrates that the certainty equivalence is no longer valid for more complex measurements of uncertainty. More specifically, if there is uncertainty about the parameters of the model, then the FED should not behave as if the uncertainty does not exist, referred to as the "Brainard uncertainty principle" Blinder (1994). In the spirit of Brainard's framework, the FED could utilize a simple form, which may be its optimal policy for assuming that everything is known with certainty.

This will typically be the case if the only source of uncertainty is an additive error term. The equation below describes a monetary policy mechanism in which inflation ( $\pi$ ) is determined by the interest rate ( $i$ ) through the known coefficient ( $b$ ) and ( $u$ ) as an error term. Utilizing Brainard's framework, we can assume that ( $y$ ) (the target variable) depends on output (GDP) ( $X$ ) with the impact of exogenous variables summarized in a single variable ( $u$ ).

$$y = bX + u$$

Where ( $b$ ) determines the response of ( $y$ ) to policy action.

According to Brainard (1967), the policymaker faces two types of uncertainty: one, he/she must make a decision he/she is uncertain about the impact of the exogenous variables ( $u$ ) that affect ( $y$ ); and, two he/she is uncertain about the response of ( $y$ ) to any given action. Referring to the above equation, the policymaker may have an guesstimate ( $\bar{a}$ ); However, the policymaker is also aware that the actual response to ( $y$ ) may differ considerably from the expected value.

## Summary

The "output or GDP gap" measure as presented and defined in this paper seems to run counter to sensible intuitive aspects of "potential output", including the fact that output rarely exceeds potential during expansive business cycles. And, by construction, the path of the "output gap" may not entirely dependent on such phenomenon. Nevertheless, because models are only an approximation to the actual economy, uncertainty about the exact structure and parameters of an economic model will continue to persist. As such, this does not mean that the entire exercise as presented in this paper is of no consequence. Rather, other sensitive measures with various modifications would present a more useful policy tool.

Data collection is in progress. We hope to present the results of the empirical study in the near future.

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# INSIGHT INTO THE BEHAVIOR OF THE WILCOXON-MANN-WHITNEY TEST AND ALTERNATIVES

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## ABSTRACT

In the two-sample problem, it is known that the Wilcoxon-Mann-Whitney test is sensitive to differences in the variances of the populations being compared. Three alternatives to the WMW test, Mee's method, Cliff's method, and the Brunner-Munzel method, are compared to the WMW for a variety of sample sizes, distributions, and unequal variance situations. Results show that the WMW test has inferior performance for a number of situations, but there is not a clear "winner" among the tests compared in this study. In particular, results show that subtle differences in the population variances can degrade performance of all the procedures considerably.

## INTRODUCTION

Statistical tests are often characterized by a number of assumptions that must be met in order for the results of the test to be interpretable. For examples, the classic t-test for comparing the means of two populations based upon independent samples requires that the two populations under consideration share a common variance and that they are both normally distributed. There is an adjustment if the variances are assumed unequal and the test is robust to the assumption of normality if the sample sizes are large enough. These facts make the two-sample t-test quite versatile and applicable to a large number of practical problems.

However, when the sample sizes are not large and the populations are known to be non-normal, alternative methods are required. A popular alternative, appearing in many introductory level statistics texts, is the rank-based Wilcoxon-Mann-Whitney (WMW) test. WMW requires independent samples and identical shapes for the populations under consideration, but no particular distribution is assumed (it is nonparametric). The WMW test is not actually a test of the difference in means or medians, though it is frequently used for these purposes.

Let  $p = P(X_{i1} < X_{i2})$ , the probability that a randomly sampled observation from the first group is less than a randomly sampled observation from the second group. If there is no difference between the groups and the distributions are identical,  $p = 1/2$ . Some have argued that there are many situations where the value of  $p$  is more interesting than the difference between any two measures of distribution location – see, for example, [1]. The WMW test is a well-known

approach for testing  $H_0: p = 1/2$ . It is called a distribution-free test because it does not require that the two populations under study conform to any particular distribution.

A common issue that applied researchers must address is whether two samples come from populations with the same “shape.” Shape is not the same as distribution – two normal distributions with different variances share the same distribution, but not the same shape – the one with the larger variance will be “shorter and fatter” than the one with the smaller variance. An implication of the “same shape” requirement is that the variances must be equal.

It is known that the WMW test is strongly affected by small differences in the variances of the populations, for both equal and un-equal sample sizes, despite the populations sharing the same distribution. In fact, it has been show that in some situations, increasing the sample sizes exacerbates the problem [2]. This somewhat counterintuitive result has spurred additional investigation into the robustness of several popular nonparametric procedures.

A number of researchers have proposed modifications to the WMW test – methods intended to improve upon the WMW test’s performance in specific situations. Three of the most promising are Mee’s method [3], Cliff’s method [4], and the Brunner-Munzel method [5]. A good reference for details of these three alternatives is the comprehensive text of Wilcox [6]. Mee’s method assumes no tied values and can maintain high power when distributions are heavy-tailed. The methods proposed by Cliff and Brunner and Munzel both allow heteroscedasticity and are designed to perform well when tied values can occur. All three methods appear promising, but no direct comparison among the three methods has been made.

The purpose of this research is to investigate and compare the performance of the WMW test and the three previously mentioned alternatives when the distributions being compared are the same, but the variances and sample sizes differ. When the difference in variances is relatively small, it may be very difficult for the applied researcher to detect the difference. In this investigation, the ratio of standard deviations of the two groups has purposefully been kept small (1.1 to 2.0). The procedures will be compared as both tests of equal means and tests of equal medians. We are focusing on how subtle and difficult to detect differences in the variances can affect the performance of the selected tests.

## DEISGN OF SIMULATION STUDY

This simulation study was carried out using the R system for statistical computing. The WMW test was carried out using the R function `wilcox.test`, which is part of the base R distribution. The functions `mee` (for Mee’s method), `cid` (for Cliff’s method), and `bmp` (for the Brunner-Munzel test) were used for the other three tests. These functions are distributed by Wilcox to support his 2005 text [6]. The regular two-sample t-test of equal means (`t.test` in R) is included in the results for reference and comparison.

Random numbers were generated using the built-in functions distributed with base R. Random numbers were standardized by subtracting the mean and dividing by the standard deviation. For

simulations with unequal standard deviations, the second sample was multiplied by the appropriate constant to create the desired ratio of standard deviations,  $\sigma_1/\sigma_2$ .

Sample size combinations considered were (20, 20), (50, 50), (20, 50), (50, 20), and (100, 100). Standard deviation ratios considered were  $\sigma_1/\sigma_2 = 1.0, 1.1, 1.2, 1.5, \text{ and } 2.0$ . The first sample is the sample with the larger standard deviation in all cases. Distributions considered in this study were normal, lognormal, and exponential distributions. Other distributions may be considered in future extensions of this work. For each combination of simulation factors, the simulation was repeated 100,000 times.

## RESULTS

Following the lead of Fagerland and Sandvik [7], the simulated significance levels are classified as 10% robust, **20% robust** or **not robust** according to whether they are within 10%, within 20%, or beyond 20% of the nominal significance level of  $\alpha = .05$ . The results of the simulations are summarized in tables 1-3.

## CONCLUSIONS

For the case of normally distributed data, summarized in table 1, WMW test gives results that are not robust in several instances. For ratio of standard deviations as small as 1.1, the error rate is outside of the 20% robust range except for the ( $n_1=20, n_2=50$ ) case, where the smaller sample size has the larger variance. Cliff's method fails to achieve an error rate within 10% of nominal in the small sample ( $n_1 = 20, n_2 = 20$ ) size cases, but is close to nominal everywhere else. Mee's method and the Brunner-Munzel method achieve error rates within 10% of nominal for all combinations of sample sizes and standard deviation ratios considered. Note that the t-test also achieves good performance in these situations, which is expected.

For the data generated from log-normal distributions and exponential distributions, results were quite different. As the ratio of standard deviations increased from 1.0 to 2.0, all methods performed more and more poorly. Performance also appears to deteriorate as sample sizes increase, which agrees with the results of Zimmerman [2]. While the t-test also has performance that is not within 20% of nominal, the error rate for the t-test are significant smaller than for the WMW test and alternatives.

It appears that the WMW test has slightly poorer performance (farther from nominal), for the error rates in all situations except ( $n_1 = 20, n_2 = 50$ ), the combination where the smaller sample has the larger variance, where WMW outperforms the alternatives. As the ratio of standard deviations increases, the difference in the performance between the WMW and the alternatives tends to increase from 1-3% to up to 12%.

Overall, the results indicate that the usefulness of the WMW test and its competing alternatives is limited by the homogeneity of the variances. Applied researchers must be very careful when

assessing the assumptions of their chosen statistical methods as even supposedly robust nonparametric methods have strong limitations.

### **FURTHER STUDY**

There are additional issues in need of study. This paper presents results for tests of equality of means for a limited set of conditions and only considers the type I error rates. Issues for further study include power under these conditions, alternative sets of conditions, and additional data distributions. Also, the tests may perform differently when the hypothesis of equal means is replaced by the hypothesis of equal medians. Sorting these issues will require additional simulations studies.

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**TABLE 1: Tests of Means; Normal Distributions.**

		Normal distributions			$\sigma_1/\sigma_2 = 1.0$	
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	4.91	4.51	<b>4.33</b>	5.24	4.98
50	50	4.76	4.59	<b>4.49</b>	4.92	4.81
20	50	4.83	4.90	4.77	5.21	5.01
50	20	4.88	4.96	4.82	5.26	5.02
100	100	5.10	5.03	4.96	5.17	5.12

		Normal distributions			$\sigma_1/\sigma_2 = 1.1$	
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	4.99	4.58	<b>4.38</b>	5.35	4.95
50	50	4.92	4.76	4.66	5.05	4.95
20	50	<b>4.37</b>	4.93	4.78	5.27	5.10
50	20	5.48	5.06	4.92	5.33	5.02
100	100	4.99	4.89	4.84	5.04	4.96

		Normal distributions			$\sigma_1/\sigma_2 = 1.2$	
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	5.02	4.58	<b>4.36</b>	5.33	4.98
50	50	4.95	4.76	4.66	5.05	4.95
20	50	<b>3.82</b>	4.76	4.62	5.08	4.88
50	20	<b>5.78</b>	4.89	4.76	5.15	4.95
100	100	5.11	4.96	4.90	5.12	5.02

		Normal distributions			$\sigma_1/\sigma_2 = 1.5$	
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	5.25	4.59	<b>4.38</b>	5.30	5.05
50	50	5.31	4.84	4.75	5.11	5.03
20	50	<b>3.13</b>	4.77	4.61	5.12	4.89
50	20	<b>7.28</b>	4.92	4.81	5.17	4.96
100	100	5.29	4.89	4.84	5.02	5.03

		Normal distributions			$\sigma_1/\sigma_2 = 2.0$	
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>5.81</b>	4.63	<b>4.46</b>	5.28	5.08
50	50	<b>5.91</b>	4.83	4.73	5.11	5.08
20	50	<b>2.57</b>	4.84	4.69	5.25	5.04
50	20	<b>9.05</b>	4.84	4.75	5.08	4.94
100	100	<b>5.86</b>	4.85	4.80	5.00	5.00

**TABLE 2: Tests of Means; Log-Normal Distributions.**

Log-Normal distributions				$\sigma_1/\sigma_2 = 1.0$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	4.86	<b>4.49</b>	<b>4.30</b>	5.24	<b>3.37</b>
50	50	5.06	4.92	4.81	5.21	<b>4.34</b>
20	50	4.75	4.85	4.70	5.15	<b>5.77</b>
50	20	4.83	4.94	4.81	5.23	<b>5.76</b>
100	100	4.97	4.92	4.86	5.05	4.55

Log-Normal distributions				$\sigma_1/\sigma_2 = 1.1$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>6.03</b>	<b>5.62</b>	5.36	<b>6.43</b>	<b>3.61</b>
50	50	<b>7.89</b>	<b>7.68</b>	<b>7.55</b>	<b>8.07</b>	<b>4.35</b>
20	50	5.47	<b>6.62</b>	<b>6.44</b>	<b>7.03</b>	5.29
50	20	<b>7.53</b>	<b>6.37</b>	<b>6.22</b>	<b>6.67</b>	<b>6.51</b>
100	100	<b>11.05</b>	<b>10.86</b>	<b>10.78</b>	<b>11.11</b>	4.44

Log-Normal distributions				$\sigma_1/\sigma_2 = 1.2$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>8.82</b>	<b>8.15</b>	<b>7.84</b>	<b>9.16</b>	<b>3.92</b>
50	50	<b>15.14</b>	<b>14.54</b>	<b>14.34</b>	<b>15.12</b>	<b>4.31</b>
20	50	<b>8.31</b>	<b>10.96</b>	<b>10.67</b>	<b>11.59</b>	4.84
50	20	<b>12.60</b>	<b>9.55</b>	<b>9.37</b>	<b>9.87</b>	<b>7.24</b>
100	100	<b>25.87</b>	<b>25.24</b>	<b>25.10</b>	<b>25.59</b>	<b>4.57</b>

Log-Normal distributions				$\sigma_1/\sigma_2 = 1.5$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>19.40</b>	<b>17.05</b>	<b>16.63</b>	<b>18.48</b>	5.08
50	50	<b>40.64</b>	<b>37.68</b>	<b>37.37</b>	<b>38.50</b>	5.22
20	50	<b>21.91</b>	<b>30.43</b>	<b>29.93</b>	<b>31.57</b>	<b>3.86</b>
50	20	<b>28.14</b>	<b>18.87</b>	<b>18.65</b>	<b>19.46</b>	<b>8.89</b>
100	100	<b>68.04</b>	<b>65.44</b>	<b>65.30</b>	<b>65.83</b>	5.10

Log-Normal distributions				$\sigma_1/\sigma_2 = 2.0$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>32.64</b>	<b>27.06</b>	<b>26.63</b>	<b>28.79</b>	<b>7.51</b>
50	50	<b>65.12</b>	<b>59.63</b>	<b>59.40</b>	<b>60.43</b>	<b>6.57</b>
20	50	<b>41.70</b>	<b>53.59</b>	<b>53.10</b>	<b>54.87</b>	<b>4.35</b>
50	20	<b>44.41</b>	<b>28.85</b>	<b>28.64</b>	<b>29.94</b>	<b>10.64</b>
100	100	<b>90.82</b>	<b>88.22</b>	<b>88.16</b>	<b>88.43</b>	<b>6.03</b>

**TABLE 3: Tests of Means; Exponential Distributions.**

Exponential distributions				$\sigma_1/\sigma_2 = 1.0$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	4.83	<b>4.44</b>	<b>4.22</b>	5.18	<b>4.35</b>
50	50	4.90	4.76	4.66	5.06	4.78
20	50	4.82	4.99	4.84	5.31	<b>5.60</b>
50	20	4.83	4.97	4.81	5.27	<b>5.67</b>
100	100	5.00	4.94	4.89	5.08	5.06

Exponential distributions				$\sigma_1/\sigma_2 = 1.1$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>5.48</b>	5.07	4.82	<b>5.83</b>	<b>4.46</b>
50	50	<b>6.61</b>	<b>6.41</b>	<b>6.28</b>	<b>6.76</b>	4.87
20	50	4.73	<b>5.73</b>	<b>5.56</b>	<b>6.11</b>	5.33
50	20	<b>6.72</b>	<b>5.73</b>	<b>5.59</b>	<b>5.98</b>	<b>5.96</b>
100	100	<b>8.23</b>	<b>8.11</b>	<b>8.04</b>	<b>8.28</b>	4.93

Exponential distributions				$\sigma_1/\sigma_2 = 1.2$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>6.90</b>	<b>6.36</b>	<b>6.07</b>	<b>7.23</b>	4.63
50	50	<b>10.25</b>	<b>9.86</b>	<b>9.71</b>	<b>10.27</b>	4.89
20	50	<b>6.07</b>	<b>8.09</b>	<b>7.87</b>	<b>8.55</b>	5.17
50	20	<b>9.51</b>	<b>7.11</b>	<b>6.95</b>	<b>7.41</b>	<b>6.11</b>
100	100	<b>15.56</b>	<b>15.10</b>	<b>15.02</b>	<b>15.41</b>	4.96

Exponential distributions				$\sigma_1/\sigma_2 = 1.5$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>12.28</b>	<b>10.73</b>	<b>10.40</b>	<b>11.82</b>	5.10
50	50	<b>23.34</b>	<b>21.38</b>	<b>21.12</b>	<b>22.02</b>	5.15
20	50	<b>11.40</b>	<b>17.05</b>	<b>16.66</b>	<b>17.88</b>	4.72
50	20	<b>18.64</b>	<b>11.92</b>	<b>11.73</b>	<b>12.39</b>	<b>6.78</b>
100	100	<b>40.70</b>	<b>38.32</b>	<b>38.18</b>	<b>38.73</b>	5.18

Exponential distributions				$\sigma_1/\sigma_2 = 2.0$		
n1	n2	WMW	MEE	CID	BMP	t-test
20	20	<b>19.26</b>	<b>15.52</b>	<b>15.15</b>	<b>16.77</b>	<b>6.05</b>
50	50	<b>38.82</b>	<b>33.93</b>	<b>33.68</b>	<b>34.70</b>	<b>5.54</b>
20	50	<b>20.09</b>	<b>29.54</b>	<b>29.12</b>	<b>30.70</b>	4.80
50	20	<b>28.10</b>	<b>16.52</b>	<b>16.37</b>	<b>17.25</b>	<b>7.42</b>
100	100	<b>64.41</b>	<b>59.58</b>	<b>59.49</b>	<b>59.96</b>	<b>5.24</b>



## **PREDICTING FEES RECEIVED IN THE LEGAL INDUSTRY**

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### **ABSTRACT**

In light of the economic downturn of 2008 and 2009, managers across the globe are seeking new methods for trimming costs. This paper addresses that issue by establishing a model for predicting future earnings in the legal industry. The model, known as PAM (Percent Application Model), builds on simple regression analysis by adjusting predictions by a set percentage. The success of this model has far-reaching implications for not only the legal industry but also any service-based company.

### **INTRODUCTION**

The economic downturn of 2008 and 2009 negatively affected most industries worldwide, including the legal profession. “In 2008, after a 17-year period of unprecedented growth, the legal services industry found itself having to take aggressive measures to reduce their costs, improve their cash positions, and shore up their capital base” [5]. With their largest clients cutting back on services, demanding deeper discounts and stockpiling cash, law firms have had to rethink how they are structured, how they perform work, and deliver value to their clients while maximizing profits for the partners.

A firm’s ability to predict future fees received is crucial to financial decision making. Predicting future cash flows can help managers identify future financial problems and make better economic decisions [9].

The objective of this study is to predict fees received six months into the future by establishing a usable correlation between the dependent variable, fees received and one or more of the following independent variables: accounts receivable (A/R), time value worked, fees billed and unbilled time. Using primary source data gathered from an international AmLaw 100 law firm, we tested the null hypothesis:

$H_0 =$  It is not possible to predict fees received within +/- 10% by regressing fees received against one of the above-mentioned variables.

$H_1 =$  It is possible to predict fees received within +/- 10% by regressing fees received against one of the above mentioned variables.

Using *KStat*, a statistical software program, we conducted regression analyses to determine which combination of variables produced a predictable relationship enabling the prediction of future fees received. The study then tested whether there were sufficient informational gains to give managers an additional tool to help make better decisions when planning for upcoming budgeted expenses, staffing levels, salary increases, bonus payments, and other financial transactions.

## LITERATURE REVIEW

The ability to use current cash flows to predict future cash flows to some point in the future is a heavily studied topic. In 1978, the Financial Accounting Standards Board (FASB) stated that the primary purpose of accounting data is “to provide information to help investors, creditors, and others to assess the amount, timing, and uncertainty of prospective net cash flows to the related enterprise” [7]. It went on to state that earnings based on accrual accounting provide a better indicator of future cash flows than current cash flows [7]. Since that time, researchers have conducted a number of studies focusing on the ability of earnings and cash flows to predict future cash flows.

A paramount study that examines the relationship between current earnings and future cash flows is the widely used prediction model developed by Dechow, Kothari and Watts (DKW). The DKW model shows that firm-specific variation in cash flow forecast errors based on aggregate earnings is significantly lower than that based on aggregate cash flows [6]. The model also provides evidence that current earnings are a better forecaster of future cash flow into the next period than current cash flow and that aggregate earnings and aggregate cash flow on future cash flows both have incremental explanatory power [6].

Building on the DKW model, Barth, Cram and Nelson (BCN) conducted research to determine if there was an association between current period cash flows and current period accrual components on cash flows one year into the future [1]. Accruals were disaggregated into their major components in order to assess their comparative importance. The five major components tested were change in accounts receivable, change in inventory, change in accounts payable, depreciation, amortization and other accruals [1]. The findings indicated that current cash flow predicted future cash flow better than current earnings and that disaggregating earnings provided better information than did aggregate earnings.

In contrast, the study, *The Ability of Earnings to Predict Future Earnings and Cash Flow* by Catherine Finger did not support the FASB’s declaration that earnings based on accrual accounting provide a better indicator of future cash flows than current cash flows used alone [8]. Using eight years of annual data from 50 firms, Finger tested whether cash flows were a better

short-term predictor of cash flows than were earnings, and if the two were equivalent predictors long-term. The results of the study revealed that current cash flows were more predictive of future cash flows than were current earnings when used in short-term predictions [8].

In addition, Bowen, et al [2] provided evidence on the ability of earnings and cash flow measures to forecast one-period and two-periods-ahead. Their findings did not confirm that earnings were a superior predictor of future cash flows than other cash flow variables as stated by the FASB. The results indicate that cash flow after investment but before financing (CFAI) and net income before extraordinary items and discounted operations (NIBEI) are equally good predictors of CFAI. However, the results show that CFAI are significantly better predictors of one- and two-period-ahead CFAI than is net income plus depreciation and amortization (NIDPR), the cash flow after several adjustments (WCFO), or changes in non-cash current assets and current liabilities (CFO).

In 1993, Lorek, Schaefer and Willinger [10] found predictive evidence supporting the seasonal Autoregressive Integrated Moving Average (ARIMA) as a model for predicting cash flows. The study also shows that the model outperforms the multivariate cross-sectional model used for predictive tests. In addition, the study provides evidence that working capital series acts similarly to net income. Later in 1996, Lorek and Willinger [11] showed that their new multivariate time-series prediction model outperformed the firm specific and common structure ARIMA as well as a multivariate, cross-sectional regression model. The multivariate time-series prediction model for cash flow data employs past values of earnings, short-term accruals and cash flow as independent variables in a time-series regression. Lorek and Willingers findings coincide with FASB's view that cash flow prediction is "enhanced by consideration of earnings and accrual accounting data" [11].

*Accounting Changes and the Accuracy of Analysts' Earnings Forecasts* by Lawrence D. Brown visited the idea of predicting future cash flows to assess future earnings. His purpose was to assess whether accounting changes significantly impaired analysts' ability to predict firms' year-ahead accounting earnings. The study differed from other studies in two fundamental ways: (1) five changes in accounting principles were examined instead of one; and (2), changes in accounting principles were related to the ability of actual financial statement users (security analysts) to assess the affected firms' future earnings numbers [3]. The results of the study suggested, "financial statement users could benefit from additional disclosures, including pro forma adjustments, when firms change their accounting principles" [3].

The majority of the literature reviewed focuses on current earnings, accruals and cash flow data as predictors of future cash flows [1]. However, empirical evidence substantiating the soundness of prediction of future cash flows using earnings, accruals and/or estimated cash flows as predictors have offered mixed results [4]. We therefore intend to contribute to the literature by examining the relationship between current fees received, fees billed, time valued worked, unbilled time at agreed and accounts receivable in predicting fees received in a service industry. Our study focuses on data gathered from a legal firm, but the methodology can be applied to other service industries to predict fees received.

## DATA ANALYSIS

### Data

A globally recognized Atlanta based law firm provided the data for this project, which consists of monthly data covering ten years. The data consists of fees received, fees billed, time value worked, unbilled time and accounts receivable. Given the proprietary nature of the data, managers at the law firm multiplied all numbers by an undisclosed factor to protect its integrity.

### Lagging

Before data manipulation, it is first necessary to lag all independent variables with respect to the corresponding dependent variable. For instance, predictions one month in the future require all data from the independent variable to correspond to one month in the future with respect to the dependent variable. Table 1 demonstrates this methodology using A/R fees as the independent variable. Therefore, to predict fees received one month into the future all data from A/R fees must lag behind one month.

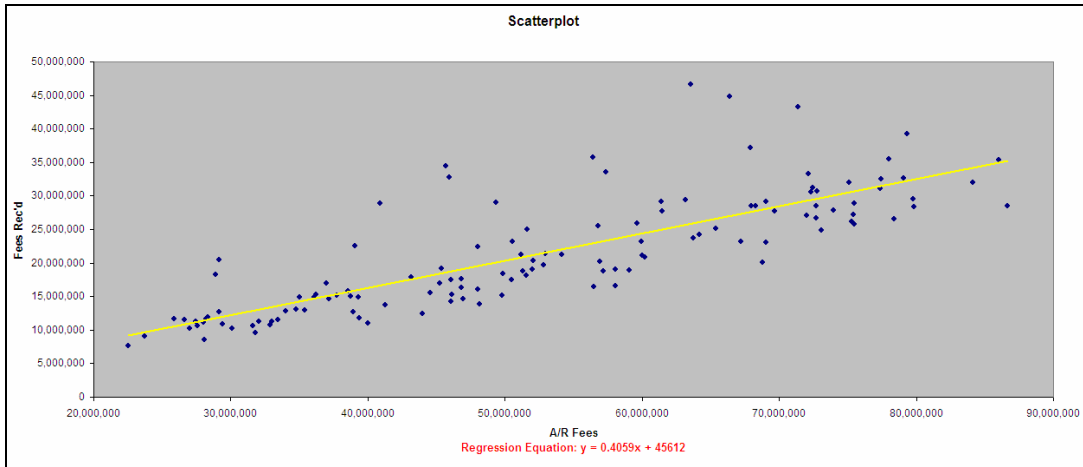
**Table 1**

Fees Rec'd	Lag'd A/R Fees					
	Lag'd 1 Mnth	Lag'd 2 Mnth	Lag'd 3 Mnth	Lag'd 4 Mnth	Lag'd 5 Mnth	Lag'd 6 Mnth
Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July
Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.
Mar.	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.
Apr.	Mar.	Feb.	Jan.	Dec.	Nov.	Oct.
May	Apr.	Mar.	Feb.	Jan.	Dec.	Nov.
Jun.	May	Apr.	Mar.	Feb.	Jan.	Dec.
July	Jun.	May	Apr.	Mar.	Feb.	Jan.
Aug.	July	Jun.	May	Apr.	Mar.	Feb.
Sept.	Aug.	July	Jun.	May	Apr.	Mar.
Oct.	Sept.	Aug.	July	Jun.	May	Apr.
Nov.	Oct.	Sept.	Aug.	July	Jun.	May
Dec.	Nov.	Oct.	Sept.	Aug.	July	Jun.

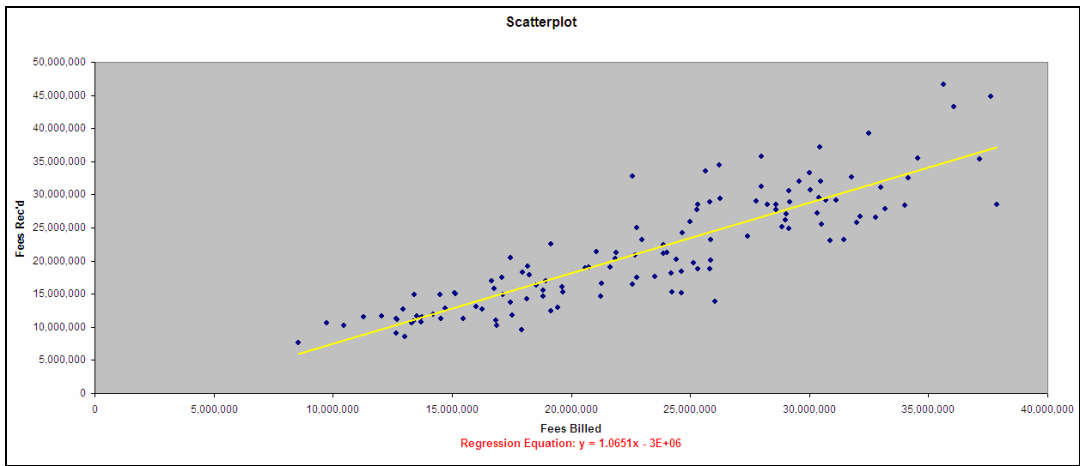
### One-on-one regression

After collecting data, initial steps involve composing scatter plots for each of the independent variables plotted against the dependent variable. The resulting graphs, displayed below, clearly demonstrate normal distributions and appear linear.

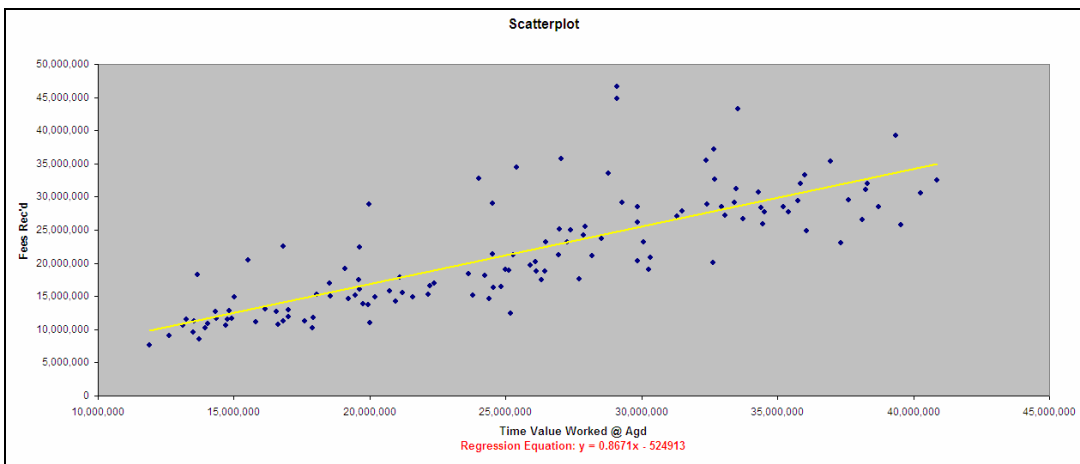
**Graph 1**



**Graph 2**



**Graph 3**



**Graph 4**

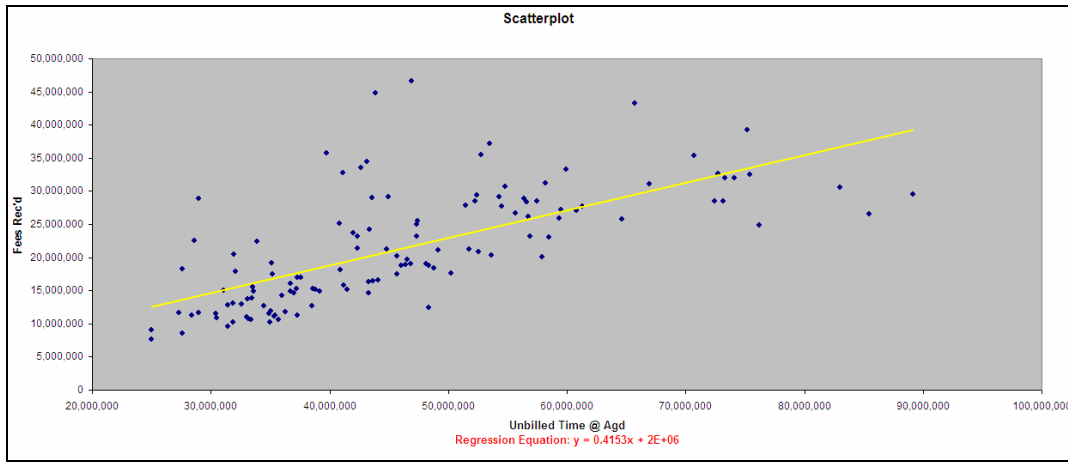


Table 2 lists each scatter-plot defined by its independent variable as well as the resulting regression equation.

**Table 2**

Scatter Plot	Regression Equation
A/R Fees	$y = 0.4059x + 45612$
Fees Billed	$y = 1.0651x - 3E+06$
Time Value Worked @ Agd	$y = 0.8671x - 524913$
Unbilled Time @ Agd	$y = 0.4153x + 2E+06$

**Regression Analysis**

Regressing each of the independent variables against the dependent variable produced the following results.

**Table 3**

Regression: Fees Rec'd					
	A/R Fees	Fees Billed	TVW @ Agd	UBT @ Agd	
<b>Coefficient</b>	0.41	1.07	0.87	0.42	
<b>std error of coef</b>	0.03	0.05	0.06	0.04	
<b>t-ratio</b>	15.17	20.24	14.50	10.27	
<b>p-value</b>	0.00	0.00	0.00	0.00	
<b>beta-weight</b>	0.81	0.88	0.79	0.68	
<b>standard error of regression</b>	5,082,817.88	4,139,673.58	5,233,756.34	6,320,848.50	
<b>R-squared</b>	65%	77%	63%	46%	
<b>adjusted R-squared</b>	0.65	0.77	0.63	0.46	
<b>number of observations</b>	125.00	125.00	125.00	125.00	
<b>residual degrees of</b>	123.00	123.00	123.00	123.00	

<b>freedom</b>				
<b>t-statistic for computing</b>				
<b>95%-confidence intervals</b>	1.98	1.98	1.98	1.98

The threshold p-value for this project is set at 5%, meaning any p-value greater than 5% indicates a strong possibility that the independent variable is equal to zero. Table 3 illustrates p-values below the threshold, allowing for rejection of the null hypothesis. While the resulting p-values were acceptable, the R-squared values were not as convincing. The R-squared value for fees billed is the strongest at 77%; however, even this value leaves much variation unexplained. The weakest R-squared value, 46%, results from regressing unbilled time at agreed, leading to the dismissal of this independent variable.

### Prediction

Continued analysis led to the construction of prediction confidence intervals for each regression. As illustrated in Table 4, the confidence intervals are large and not within an acceptable range; therefore, one-on-one regression analysis does not yield an accurate model for predicting fees received.

Table 4

<b>Confidence Limits For Prediction</b>	<b>A/R Fees</b>	<b>Fees Billed</b>	<b>TVW @ Agd</b>	<b>UBT @ Agd</b>
Lower	1,266,305.39	2,413,004.99	892,746.01	1,067,583.65
Upper	<u>21,634,609.42</u>	<u>18,999,074.01</u>	<u>21,873,936.75</u>	<u>26,364,538.24</u>
<b>Difference</b>	20,368,304.02	16,586,069.02	20,981,190.74	25,296,954.59

### Multiple Regression

After determining that one-to-one regressions are inconclusive, we regressed each of the independent variables as a group against the dependent variable. Table 5 highlights the results of this regression:

Table 5

<b>Regression: Fees Rec'd</b>				
	<b>A/R Fees</b>	<b>Fees Billed</b>	<b>TVW @ Agd</b>	<b>UBT @ Agd</b>
Coefficient	(0.078622)	1.016396	0.358913	(0.083653)
std error of coef	0.086715	0.140618	0.189702	0.069957
t-ratio	(0.906667)	7.228040	1.891982	(1.195781)
p-value	<b>36.6400%</b>	<b>0.0000%</b>	<b>6.0903%</b>	<b>23.4140%</b>
beta-weight	(0.156379)	0.836826	0.328751	(0.136841)
standard error of regression	4,129,695.40			
R-squared	<b>0.7757</b>			
adjusted R-squared	0.7683			

number of observations	125.00
residual degrees of freedom	120.00
t-statistic for computing 95%-confidence intervals	1.9799

As illustrated in Table 5, the p-values for three of the independent variables in the regression are well above our 5% alpha threshold, which does not allow us to reject the null hypothesis that the independent variable is equal to zero.

### Prediction

Continued analysis led to the assembly of prediction confidence intervals for the regression. As illustrated in Table 6, the confidence interval for this regression is large and not within an acceptable range.

**Table 6**

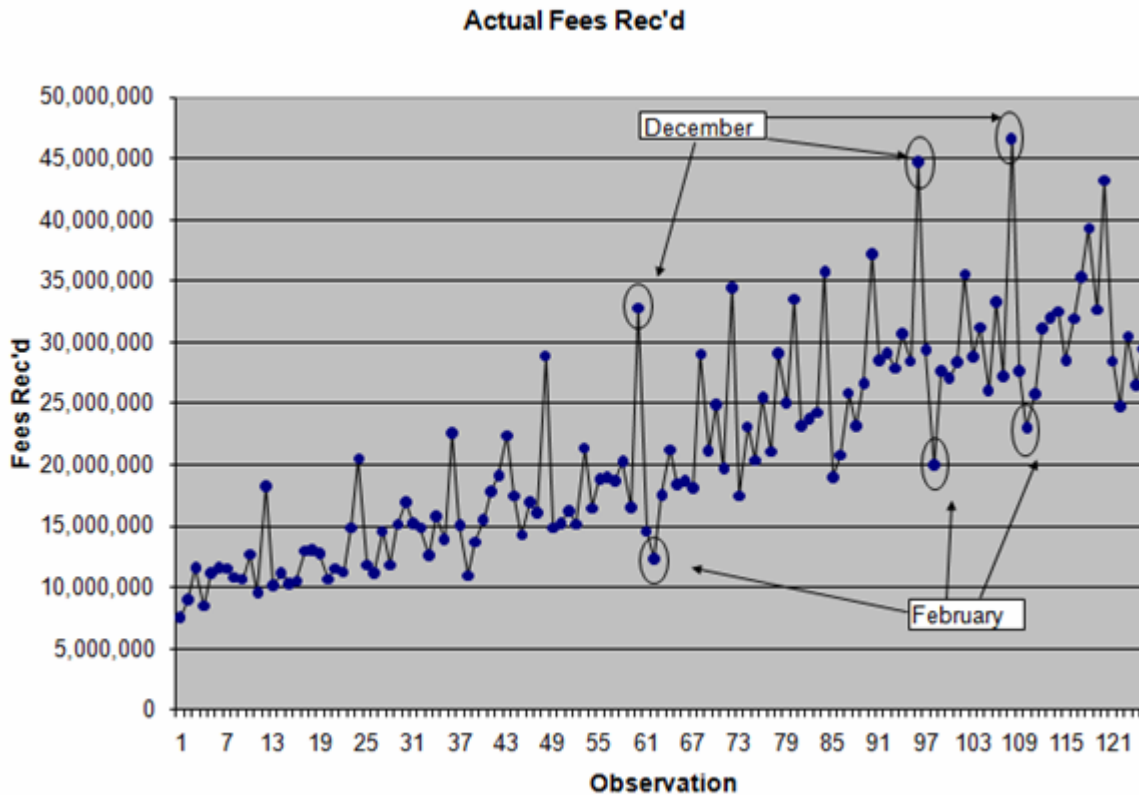
<b>Confidence Limits For Prediction</b>	
Lower	2,241,808.6985
Upper	<u>18,805,643.3624</u>
<b>Difference</b>	16,563,834.6639

### Conclusion

Despite occasional signs of promise, the above methods were unable to predict fees received with any accuracy. These findings prompted a careful re-examination of the data that make up fees received. After plotting the data using Excel's graph function it became clear there existed seasonal trends. Table 1 clearly shows a spike in fees received during December and a significant drop during February, while variations between other months appear relatively stable.



Graph 5



The peaks and valleys represent annually occurring outliers that have a significant impact on forecasting accuracy. The months of December and February diminish the accuracy of any regression model predicated on the least squared technique. An analogous example is the effect a grade of zero has on a student's overall grade point average, despite otherwise stellar performance. The zero disproportionately lowers the average much the same as December and February in this case. This discovery meant that the data must first undergo a smoothing process before conducting a regression analysis.

### Moving Averages

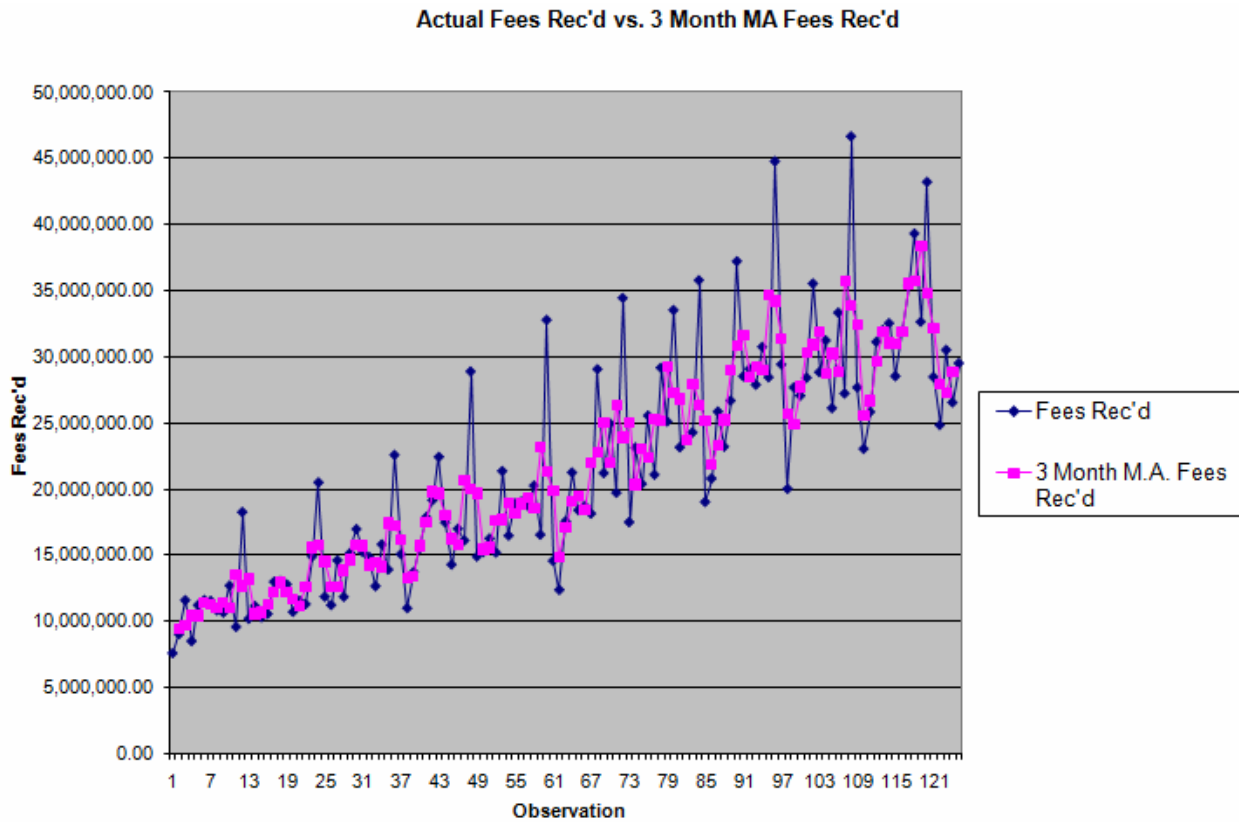
While there are a number of smoothing or de-seasonalizing techniques available, a moving average specifically targets data with a temporal aspect, making it a suitable choice for this project. The moving averages selected for this project are limited to those containing three and four observations. After conducting a regression and prediction analysis using the de-seasonalized data and independent variables listed earlier, A/R fees demonstrated the most promise. Having the highest R-squared values and narrowest confidence limits for predictions, A/R fees are therefore the focus of the research for the remainder of the project.

### Three-month Moving Average

To calculate the three-month moving average, three consecutive months (one prior, one current and one subsequent month) were averaged to produce three-month moving average fees

received. Graph 6 shows actual fees received and the smoothing effect the three-month moving average has on them. The moving average reduces the severity of the fluctuations in fees received, paving the way for a regression analysis.

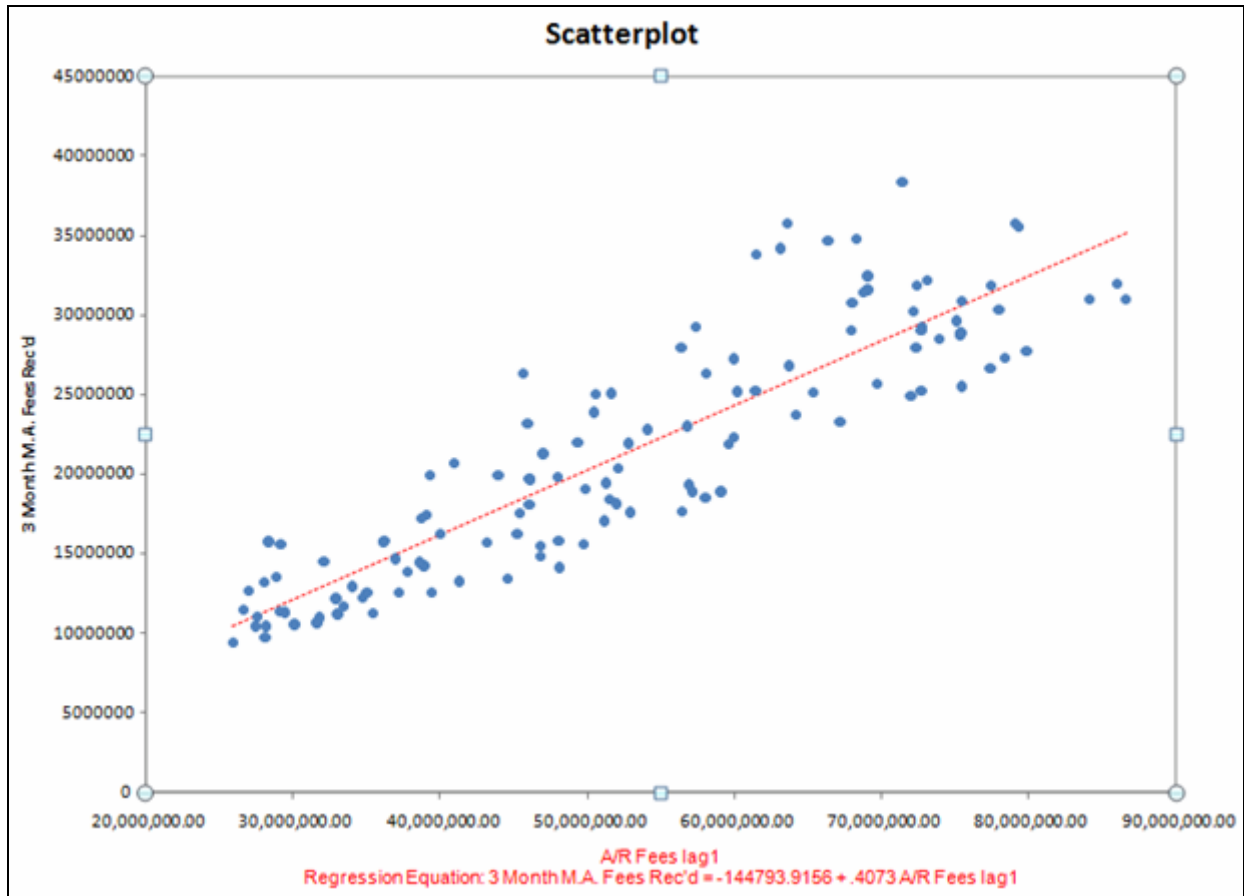
**Graph 6**



## Scatter-plot Analysis

Graph 7 displays the scatter plot of the three-month moving average plotted against A/R fees received lagged one month.

Graph 7



The points exhibit a linear progression concentrated closely around the regression line. Evident also from the graph is the appearance of a normal distribution with limited outliers. The resulting regression equation is as follows:

$$\text{Fees Received} = -144793.9156 + .4073(\text{A/R Fees lagged 1 month}) \quad (1)$$

## Regression Analysis

The three-month moving average fees received regressed against A/R fees lagged one-month received produce the following results:

Table 7

Regression: 3 Month M.A. Fees Rec'd		
	constant	A/R Fees lag1
coefficient	-144793.92	0.407304642
std error of coef	1044179.83	0.018852012
t-ratio	-0.1387	21.6054
significance	88.9945%	0.0000%
beta-weight		0.8919
standard error of regression		3456701.068
coefficient of determination		79.55%
adjusted coef of determination		79.38%
number of observations		122
residual degrees of freedom		120
t-statistic for computing 95%-confidence intervals		1.9799

The p-value of 0% is below the threshold, leading to the rejection of the null hypothesis that the independent variable is equal to zero. The R-squared is 79.55%, indicating that the regression equation explains most of the variation in the dependent variable. These findings suggest a strong relationship between fees received using a three-month moving average and A/R fees lagged one month.

## Prediction

The prediction analysis in Table 6 uses a 95% confidence level and a random value for A/R fees received lagged one month to produce confidence limits for prediction with a difference of \$13,866,816.15. This difference suggests the prediction is within +/- \$6,933,408.07 of the actual three-month moving average fees received, which is not within an acceptable range.

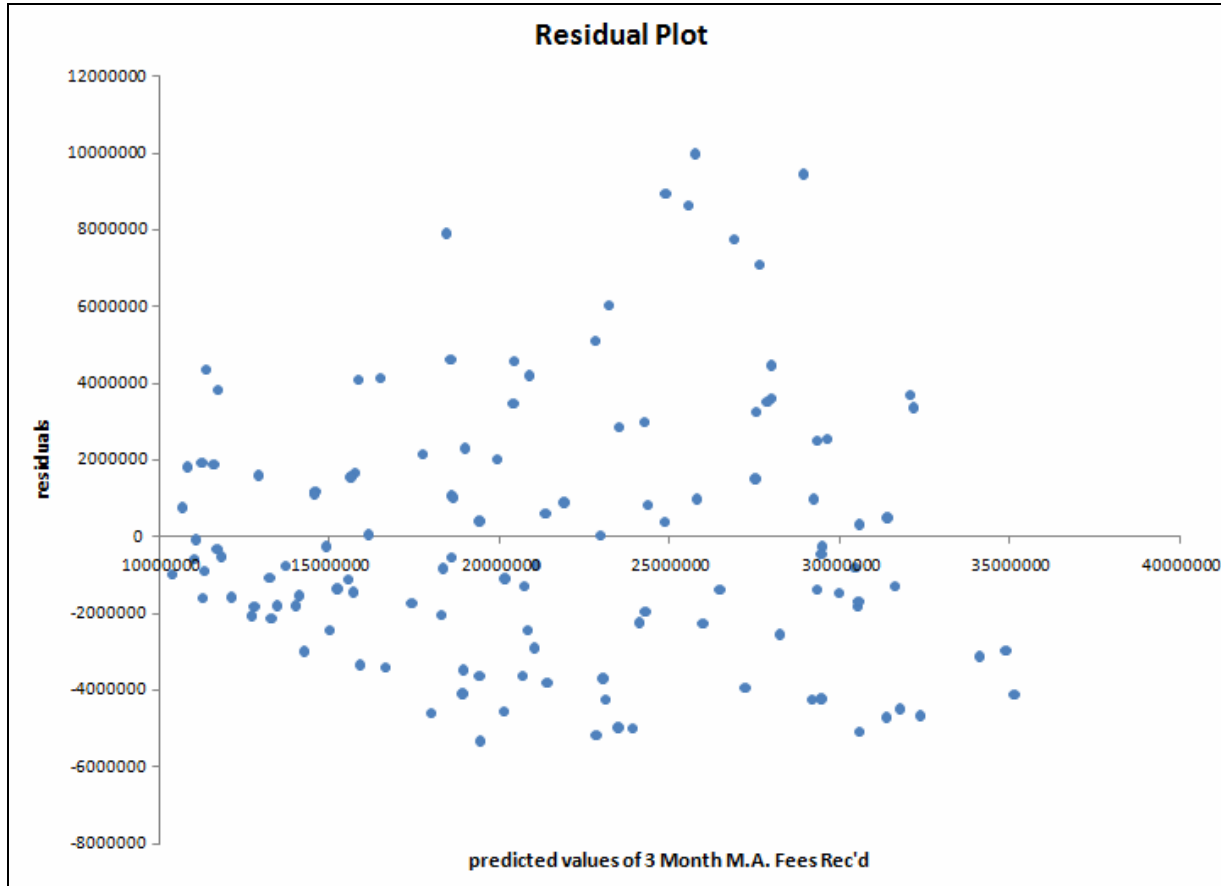
**Table 8**

<b>Prediction, using most-recent regression</b>			
	<b>constant</b>	<b>A/R Fees lag1</b>	
<b>coefficients</b>	-144793.92	0.407304642	
<b>values for prediction</b>		28,178,141.07	
<b>predicted value of 3 Month M.A. Fees Rec'd</b>		11332293.76	
<b>standard error of prediction</b>		3501844.378	
<b>standard error of regression</b>		3456701.068	
<b>standard error of estimated mean</b>		560474.5983	
<b>confidence level</b>	<b>95.00%</b>		
<b>t-statistic</b>	1.9799		
<b>residual degr. freedom</b>	120		
<b>confidence limits for prediction</b>	<b>lower</b>	4398885.684	<b>Difference</b> 13866816
	<b>upper</b>	18265701.83	
<b>confidence limits for estimated mean</b>	<b>lower</b>	10222593.07	
	<b>upper</b>	12441994.44	

## Residual Plot

Plotting the residuals against the predicted values reveals no systematic distribution, further indicating the strength of the relationship between the two variables.

Graph 8



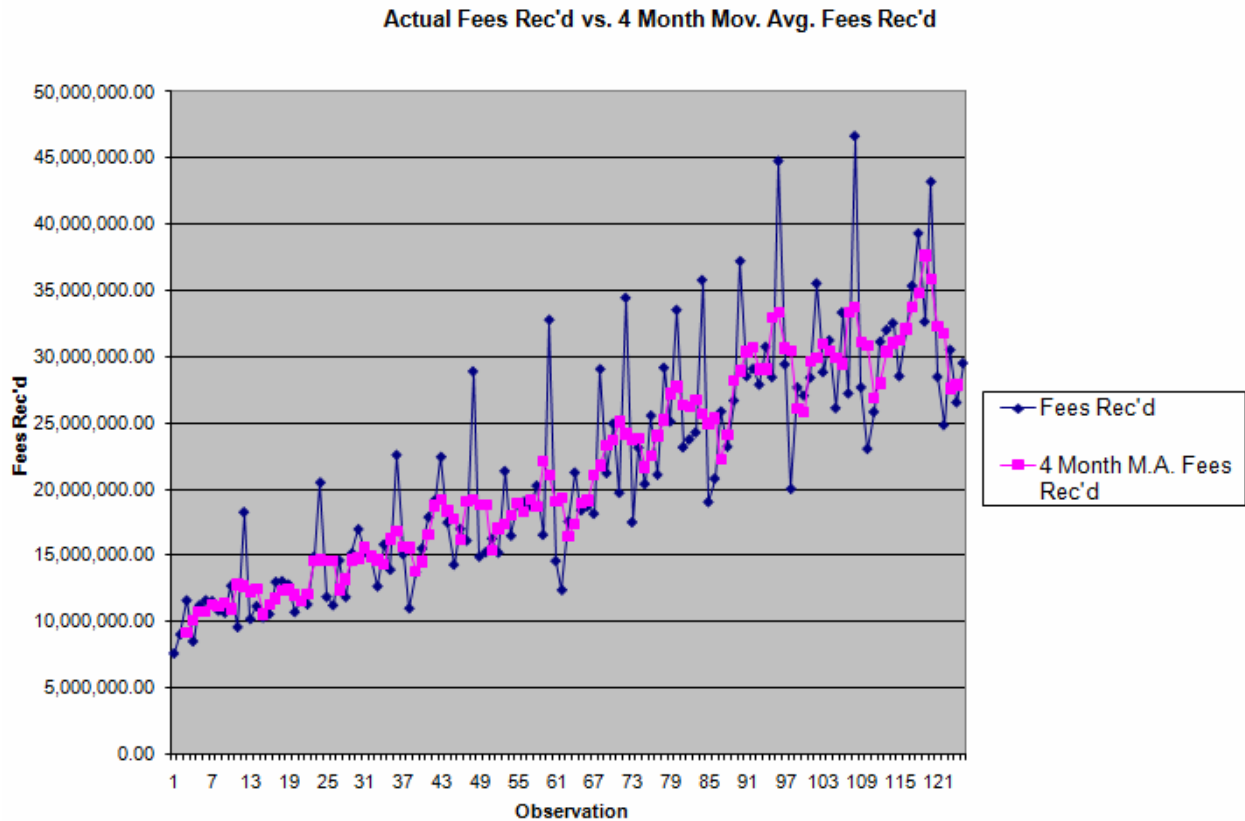
## Conclusions

While these findings improve upon prior work, they are not sufficient for managers to utilize in a confident and accurate manner. Smaller confidence limits for prediction are necessary for the model to have relevance.

## Four-Month Moving Average

To calculate the four-month moving average, four consecutive months (two prior, one current and one subsequent month) were averaged to produce four-month moving average fees received. Plotting the four-month moving average fees received produced a smoother graph, minimizing the fluctuations even further.

Graph 9



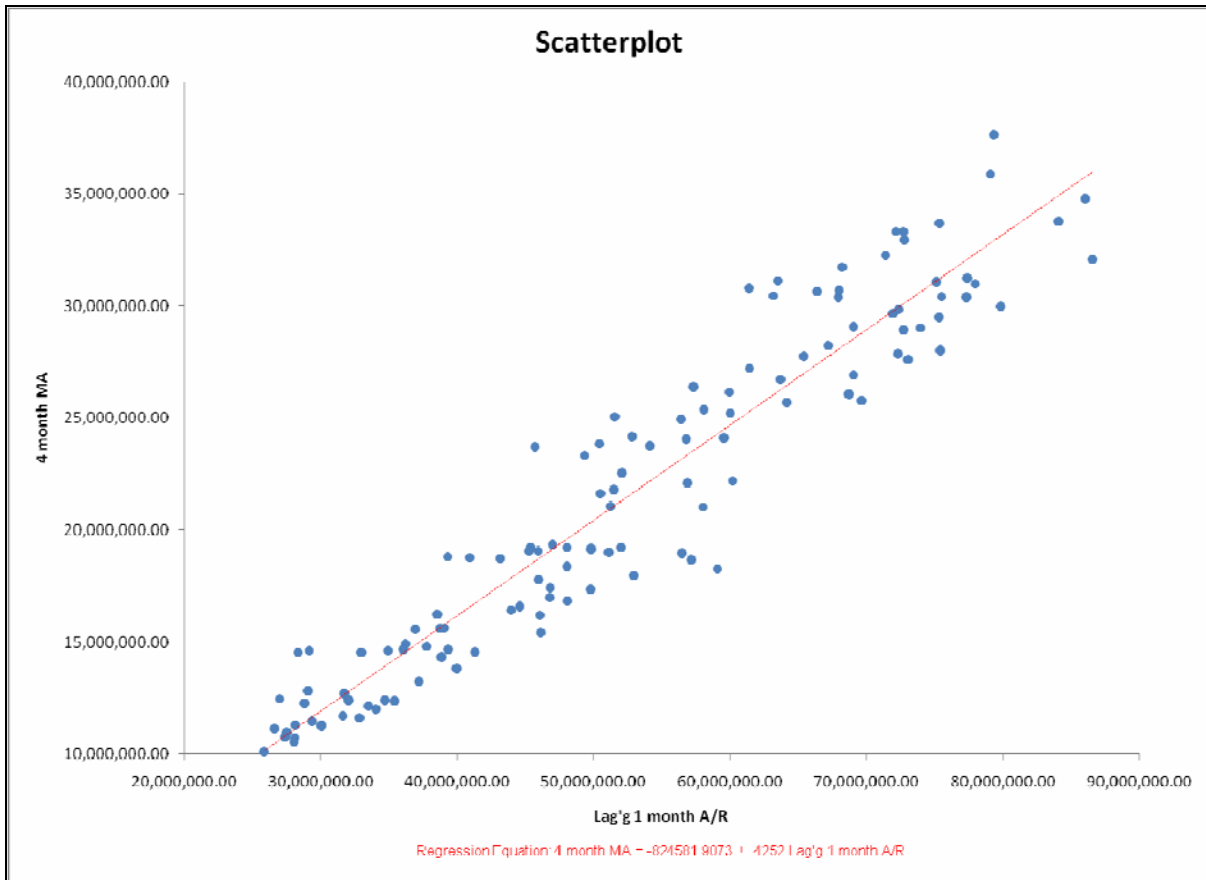
### Scatter-plot Analysis

A scatter-plot of four-month moving average fees received plotted against A/R lagged one-month reveals a normal and linear distribution producing the following regression equation:

$$\text{Fees Received} = -824581.9073 + (.4252 * \text{Lag'd 1 month A/R}) \quad (2)$$

The points also exhibit a tighter fit to the regression line than other models demonstrating the strengthening relationship between fees received and A/R.

Graph 10





## Regression Analysis

The p-value of 0% is below the threshold, leading to the rejection of the null hypothesis that the independent variable is equal to zero. The R-squared is 90.77%, indicating that the regression equation explains most of the variation in the dependent variable. These findings suggest a strong relationship between fees received using a four-month moving average and A/R fees lagged one month.

**Table 9**

<b>Regression: 4 month MA</b>		
	<b>Constant</b>	<b>Lag'd 1 month A/R</b>
<b>Coefficient</b>	824581.91	0.425231658
<b>std error of coef</b>	685634.05	0.012430305
<b>t-ratio</b>	-1.2027	34.2093
<b>Significance</b>	23.1497%	0.0000%
<b>beta-weight</b>		0.9527
<b>standard error of regression</b>		2256811.75
<b>coefficient of determination</b>		90.77%
<b>adjusted coef of determination</b>		90.69%
<b>number of observations</b>		121
<b>residual degrees of freedom</b>		119
<b>t-statistic for computing 95%-confidence intervals</b>		1.9801

## Prediction

In the prediction analysis listed below, the confidence limits for prediction using a random lagged one-month A/R value initially appear large at a value of \$9,055,174.62. However, this means that the prediction is within +/- \$4,502,587.3, which is much improved. In light of the improved confidence limits, predictions were calculated for each month spanning ten years to test the accuracy of the model. The results of these calculations, revealed an equation that produced results that on average deviated 12.72% from the true observations.

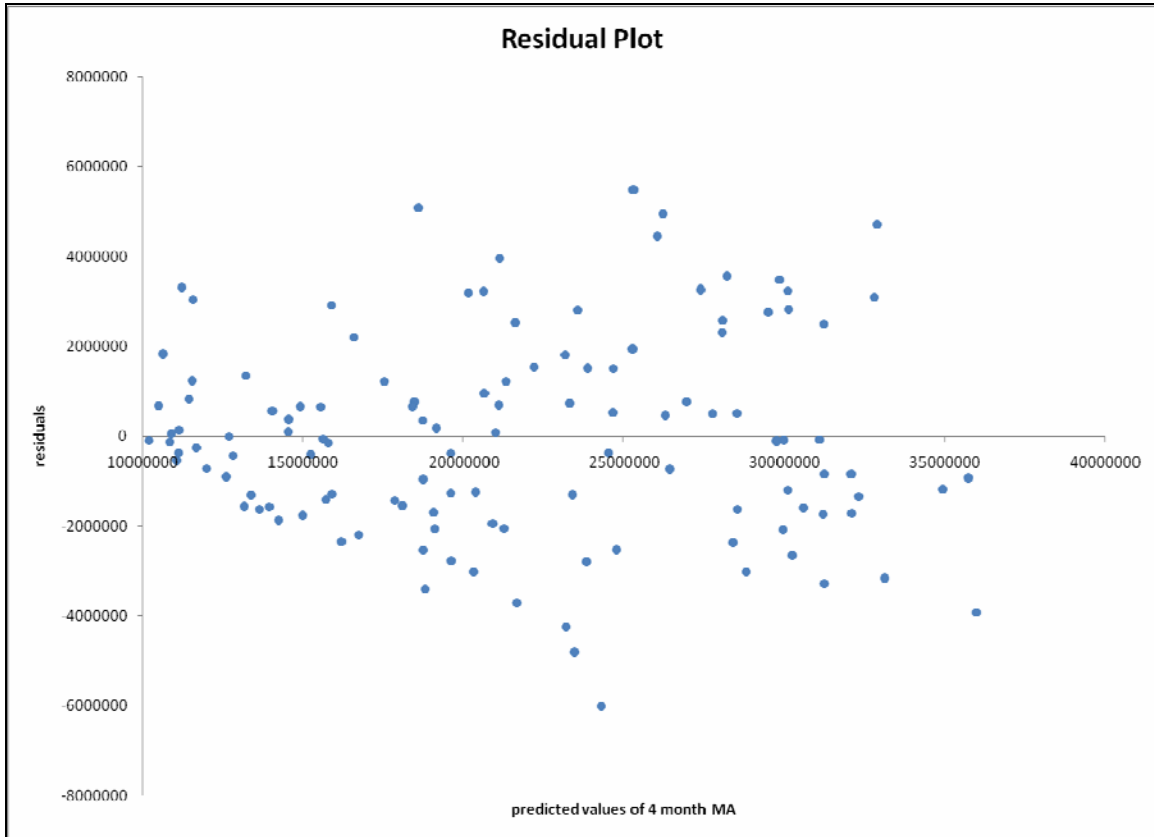
Table 10

<b>Prediction</b>			
	<b>Constant</b>	<b>Lag'g 1 month A/R</b>	
<b>Coefficients</b>	-824582	0.425231658	
<b>values for prediction</b>		28,097,931.06	
<b>predicted value of 4 month MA</b>		11123547.9	
<b>standard error of prediction</b>		2286544.947	
<b>standard error of regression</b>		2256811.75	
<b>standard error of estimated mean</b>		367543.8991	
<b>confidence level</b>	<b>95.00%</b>		
<b>t-statistic</b>	1.9801		
<b>residual degr. Freedom</b>	119		
<b>confidence limits for prediction</b>	<b>Lower</b>	6595960.585	<b>Difference 9055174.624</b>
	<b>Upper</b>	15651135.21	
<b>confidence limits for estimated mean</b>	<b>Lower</b>	10395774.28	
	<b>Upper</b>	11851321.52	

## Residual Plot

By plotting the residuals against the predicted values, it is evident that no systematic distribution exists.

Graph 11



## Conclusion

Four-month moving average fees received regressed against A/R fees produced favorable results, yet the predicting power is still not strong enough to warrant its use as a forecasting model. Unacceptable confidence limits are too broad for the model to have a substantial impact on forecasts, although they are better than those produced using the three-month moving average. Despite the shortcomings, these results provide the basis for adjustments to the regression equation.

## Percent Application Model (PAM)

Sorting the predictions made using the four-month moving average by month revealed a common thread congruent with the effects of seasonality. That is, most months appeared to have similar variances in terms of the difference between actual fees received and predicted fees received. Expressing this as a percentage by dividing the difference by the predicted value for

each month provides vital information by illustrating whether the model over or under-predicted. The operator in front of the percentage, either negative or positive, conveys this information with negative signs denoting over-prediction. The ramifications of this are far reaching in terms of using this model as a management tool. For example, the average percent difference the prediction is away from the actual fees received for January is -5.97%. Therefore, on average for the month of January, the model over-predicts by 5.97 %. Executive management can use the model with the understanding that on average the model over-predicts for the month of January, which allows them to make better-informed decisions when interpreting the prediction. The absolute value of the percent-difference is also taken to give a more realistic idea of how far the prediction is from the actual fees received. Taking the absolute percent-difference for each month convey exactly how far from the predicted fees received are from the actual fees received.

By using the average non-absolute percent-difference, it is possible to create an additional equation capable of producing predictions that are more accurate. By taking the average percent-difference the prediction is from the actual fees received for a particular month and applying it to the prediction for the same month, it is possible to produce a more accurate calculation. The new prediction equation, affectionately known as PAM (Percent Application Model), is as follows:

$$\text{Prediction2} = \text{Prediction 1} + (\text{Prediction1} * \text{Average Percent Difference}) \quad (3)$$

## RESULTS

By using this equation, it is possible to predict fees received within +/- 10% up to three months into the future. Table 9 shows the average absolute value of the percent error of the prediction using PAM for predictions up to six months in the future versus those without PAM. The evidence clearly shows a significant drawdown in the percent difference using PAM. Predicting one month in the future, for example, yields results on average within 8.78% of the actual fees received. Whereas using the model without PAM increases the absolute percent difference by 3.94%. For predictions six-months in the future PAM decreases the error by 7.74%.

**Table 11**

	Mn 1	Mn 2	Mn 3	Mn 4	Mn 5	Mn 6
Avg. ABS Actual % Diff (w/PAM)	8.78%	9.25%	9.62%	10.15%	10.21%	9.99%
Avg. ABS Actual % Diff	<u>12.72%</u>	<u>14.94%</u>	<u>15.51%</u>	<u>17.73%</u>	<u>17.23%</u>	<u>17.73%</u>
% Difference	<b>-3.94%</b>	<b>-5.69%</b>	<b>-5.89%</b>	<b>-7.58%</b>	<b>-7.03%</b>	<b>-7.74%</b>

These findings solidify the alternative hypothesis:

$$H_1 = \text{It is possible to predict fees received within +/- 10\% by regressing fees received against one of the above mentioned variables.}$$

Managers at an AmLaw100 law firm are currently using PAM to predict fees received six months in advance. Predicted fees received were compared to actual data and were found to be accurate within +/-3% for predictions up to three months in advance. The prediction for four

months in advance is within the 10% threshold. Predictions for months five and six under predicted at a larger rate.

### **RECCOMENDATIONS**

The Percent Application Model (PAM) provides managers in the professional services industry with a useful tool for predicting fees received. By using the findings of this research, decision makers can more accurately forecast their budgets and make sound financial decisions.

The accuracy of PAM strengthens if the data are updated monthly as new numbers become available. After January's month end, the actual fees received amount should be input into the data set and the regression analysis conducted again. Calculating predictions from actual funds increases accuracy compared with those from predicted funds.

Future research should examine if the Predictive Application Model would be appropriate for other types of professional service firms such as accounting and architectural firms.

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# ORGANIZATIONAL RUMORS: A FUNCTIONAL MATHEMATICAL MODEL

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## ABSTRACT

Research in organizational rumors has had a long and varied history. Since the initial proposals formed in the World War II era, scientists have been guided down wrong paths as well as enlightening ones. Pivotal landmarks have clarified the research and set the course for future endeavors. One key focus has been rumor transmission rate. Studies have proposed a general sense that this rate is associated with factors surrounding the rumor or individual, as well as interaction terms. This paper proposes a mathematical model describing the functional relationship between transmission rate and those factors, leaving room for coefficients to describe the relative strengths of each.

## INTRODUCTION

From as far back as World War II, researchers have been interested in the mechanics behind rumor formation and transmission. Scholars of organizational management have found this to be a useful area to investigate because the potential for rumors to have significant psychological and financial impacts is great. The full range of effects is summarized as follows: “Rumors... can drain productivity, reduce profits, create stress in the workplace, or sully a company's image. Some rumors tear at a company's credibility, with both personnel and customers. Others have catapulted firms into financial disaster.” [8]. With these consequences in mind, it behooves management to be familiar with how rumors form, how and when they are heard, the factors affecting their spread, and what to do about them, if anything.

This paper will focus primarily on rumor transmission, starting with a well-accepted starting point put forth by pioneers in organizational rumor research [3]:

$$R = (i) \cdot (a) \tag{1}$$

This relationship was proposed to emphasize that the intensity of the rumor,  $R$ , is directly and positively affected by the importance of the subject matter,  $i$ , and the ambiguity of the facts,  $a$ . Using this starting point for a relational formula, we will first express the intensity of the rumor as a function of importance and ambiguity in this manner:

$$R = f(i, a) \tag{2}$$

and will proceed with the development of a model incorporating the results of some pivotal studies and conclusions drawn by contemporary researchers over the decades since the initial groundwork was first laid.

## **REVIEW OF EARLY LITERATURE**

Rumors generally can be defined as unverified information of uncertain origin which is usually spread by word of mouth [1]. They are also described as propositions for belief that are passed from one individual to another without any proof or evidence of truth [2]. The important components of rumor are that the information has an ambiguous source, it is proposed as truth without evidence of such, and it is spread by word of mouth, thereby jumping over individuals in the formal chain of communication. It is not necessary for rumors to have a negative connotation. As will be described later, some classifications of rumor are positive, rather than negative.

### **Rumor vs. Gossip**

It is important to distinguish rumor from gossip. In the lay world, the two may seem to be one and the same. Often, when somebody refers to a rumor, the accurate term is gossip, as has been defined in organizational management circles. The two are separate entities with the primary distinguishing characteristic being the subject of the information, or target [6]. A rumor typically targets an organization whereas gossip targets a person or specific people, and serves social and political agendas. Gossip has more entertainment value and is meant to convey mores [8]. It is idle talk, tittle-tattle, malicious tales, and scandal [14]. It is often derogatory, however gossip, like rumor, is not always negative. Likewise, both may have a kernel of truth or some basis in truth.

### **Rumor and Gossip in the Grapevine**

Both rumor and gossip are part of a larger concept known as informal communications. These communications are undocumented, open to change, and bypass individuals in the usual communication chain. Grapevine is the term often given to the combination of both rumor and gossip. It is continuous as long as members of the grapevine are in contact with one another. For example, in an organizational setting, grapevine activity could start during the morning carpool and continue until the evening's bowling league disperses [13]. It is important to note two things: First, the grapevine is equally active among managers and line workers; it is a fallacy to assume only line workers churn the rumor mill. Second, it is possible to use the grapevine to one's benefit, so it is neither necessary nor correct to connect negativity with the grapevine or any network of informal communications.

Informal communications are about 80% directed toward individuals and 20% toward companies [13]. Using the distinction between rumor and gossip as related to the target, this shows that only 20% of informal communications are rumors. The remaining communications fall into non-rumor categories, primarily gossip.

It would be prudent here to give a brief statement about formal communications. In an organization, there are official communications such as memos, press releases, newsletters, and the like. These are formal communications. They have a known source that is presumed to be credible, and the information contained within is expected to be accurate or have a large bearing in proven or known facts. The purpose of communication from official sources is to provide to relevant others information that is known or thought to be true at the time. External to



organizations, formal communications can include newspapers, magazines, and other forms of mass media, however it should be noted that these forms of communication often contain gossip as well. In fact, some can be said to broker in gossip, and offer juicy tidbits of their contents on their covers to lure shoppers as they wait in line with their groceries.

### **Why We Should Study Rumors**

All organizations must face the effects of rumors at some point. The prevalent opinion is that rumor is unavoidable and that the difference between those organizations who suffer from the effects and those who do not is in how rumors are controlled. It is useful to compare companies who have successfully weathered a rumor event and those who have not by pinpointing the techniques that work and those that backfire. It can be concluded from the keen interest and focus on controlling and stopping rumors that these distinctions are important.

There are several ways in which an organization's resources are vulnerable due to the detrimental effects of rumors. They are: 1) loss of productive time available to workers, both on the line and in management, 2) loss of employee morale, loyalty, and teamwork, 3) negative reputation gleaned by the company, 4) sales dips due to immediate and large-scale public responses such as boycotts, 5) non-product related responses from inside or outside the company, such as destruction of property or threats to employees, and 6) use of resources such as advertising efforts, internal PR, etc. to combat and correct the effects of the rumors [10]. All these translate into profit losses.

Although the primary reason to study rumors is to protect company profits, other reasons stem from this initial goal. Understanding rumors and the grapevine and knowing their characteristics enables management to determine whether they are liabilities or assets.

Rumors are generally expected to move very quickly and accurately. In fact, it has repeatedly been shown that rumors are at least 75% accurate. An early study showed that grapevine information was 75% to 95% correct [7]. A subsequent study found grapevine information to be at least 80% accurate, substantiating the earlier study [5]. Knowing that rumors are generally accurate and quick to spread makes them of interest to managers because the speed at which damage is done can devastate a company before prudent action can be taken.

However, informal communications need not always be negative. It has been shown that by understanding the speed, accuracy, and inclusiveness of the grapevine, it is quite possible for management to use the grapevine as an asset. Grapevines are often superior to the formal channels of communication in quantity, speed, and accuracy [11]. A 1969 study done by Harold Sutton showed that about 80% of the rumor public will receive information via the grapevine [12], therefore it can be used as a test bed for new ideas or as a means of getting information out quickly. For example, if a dining facility's manager just found out a health inspector was on the way, issuing a memo would be far less effective than inserting this information into the grapevine, allowing employees to prepare.

Keeping a finger on the grapevine can also be used as a measure of health [13]. The grapevine can reveal issues and problems among employees and the effects of policies. Keeping abreast of the grapevine can give management a heads-up that there is a sickness brewing in the body of the

organization and good management will administer medicine immediately, before a full-blown illness brings the company down.

## **Rumor Types**

Two classes of rumors are spontaneous rumors and premeditated rumors [15]. They differ in when and how they occur. Spontaneous rumors occur in an environment of stress, anxiety, and mistrust and show up seemingly from nowhere, working their way through the rumor public in the usual way. Premeditated rumors are planted. If management has utilized the grapevine to spread information or to test a new idea, this rumor was premeditated - put into the grapevine on purpose to serve a need of the manager. Premeditated rumors may also be malicious, planted to have a certain effect on members of the rumor public or on the company itself. These occur in highly competitive environments. Examples of this type of premeditated rumor are found among financial blogs. People post negative or positive information about a company in the hopes of influencing market activity. Sometimes people are hired to engage in this activity.

There have been various other attempts to classify rumors, and two have become generally accepted in the literature. The first, based on the proposal of Robert Knapp during his work with Gordon Allport in the 1940's proposed that rumors are of three types: wedge-drivers, bogies, and pipe-dreams [10]. Wedge-drivers act in a way that divides the people. They put people in a position of taking sides, and can go so far as to break personal friendships. In a corporate environment where teamwork is an essential part of everyday life, this type of rumor can be devastating. Bogies serve to scare the people, working from their fears. Rumors that scare people can cause them to react in ways that are less logical or thought-out than they might be normally. This type of rumor is effective in the stock market where people feel they have to react quickly to news, before the market can react. As stated earlier, not all rumors are negative. Pipe-dream rumors work on the fantasies of the rumor public. An example among employees is a positive rumor about the year-end bonus or new stock plan. One negative result of these rumors is the disappointment that may be felt if the rumors don't come true.

The other generally accepted classification of rumors proposed that they reflect either wish or dread [18]. Wish rumors reflect some level of wishful thinking and fantasizing, and can be generally considered positive rumors. Dread rumors are just the opposite, causing fear or negative consequences. In a further study, when individuals were allowed to classify the rumors they experienced, some rumors fit neither category, forming a third classification of 'neither wish nor dread' [17]. This third 'non-committed' class of rumors is not often referred to in future studies, but it should be noted that as perceived by the recipient of a rumor, sometimes neither wish nor dread is felt; the rumor appears to have a neutral consequence.

## **People Types**

In studying rumor transmission, it would be neglectful to disregard the effects of the individuals themselves. The transmission of a rumor cannot be predicted solely on the characteristics of the rumor, even though that is where much of the research lies. Ultimately, individuals are responsible for transmitting the rumor, and thought certainly goes into the decision of whether or not to pass on what one has heard without verifiable evidence. 'People types' were identified by Harold Sutton in 1969 and summarized in a future study as liaisons, dead-enders, and isolates

[10]. Liaisons are those who pass on rumors, and make up 9% of the rumor public. Dead-enders hear rumors but choose not to pass them on, and make up 69% of the rumor public. All others are those who never hear the rumor, and are called isolates. It is important to note that almost 80% of the rumor public receives grapevine information. Even though only 9% of the people are liaisons, nearly 80% can be reached via this mode of communication.

One might wonder why it is that grapevine information can move so quickly if less than 10% of the rumor public transmit rumors. This is pondered in the literature and indeed some cases have found that rumors move rather slowly. “Apparently if rumors spread like wildfire, wildfire must move relatively carefully and with slow deliberation.” [19]. In this case, it appeared that rumors in a crisis situation were more carefully weighed, and people waited to hear a rumor from more than one source before passing it on. This gave the rumor transmitter some level of confidence in the truth of the rumor. As we will see, believing the rumor as truth is one of the factors associated with rumor transmission. Given that liaisons are the only ones spreading rumors, predicting rumor transmission is akin to predicting whether the receiver of a rumor will act as a liaison or a dead-ender with respect to a given rumor. It is therefore of some import to be able to distinguish between these two types of members of the rumor public.

### **EXPANDING ON THE FACTORS AFFECTING RUMOR TRANSMISSION**

In the classic study of rumors by Allport and Postman, an attempt was made to assign a mathematical formula to the transmission of rumors that related the strength of a rumor to its importance and ambiguity [3]. As stated previously, the initial formula is more accurately expressed as a function of its variables in order to allow for descriptive coefficients expressing the strength of each factor. We begin here with the functional relationship:

$$R = f(i,a) \tag{3}$$

As yet, we do not know the full effect of importance, ambiguity, and other factors that have been shown to have a relational effect on  $R$ . As studies continue and additional relationships are theorized and proven, this functional expression can be modified to include the new-found knowledge. For example, some factors may appear to have a curvilinear effect on the transmission of rumors. An equation showing a curvilinear effect might include a squared term to represent this factor,  $x$ , modifying the equation to something of the sort:

$$R = f(i,a,x^2) \tag{4}$$

The model will be built upon in the following sections to incorporate several factors that have been proposed by researchers of rumor transmission. The studies used are not all-inclusive, but do hinge on some of the more basic works of researchers that can be readily incorporated into the model.

### **Defining The Initial Factors**

A pivotal work in the early 90's by Ralph Rosnow proposed four factors of rumor transmission, identified as general uncertainty, outcome-relevant involvement, personal anxiety, and credulity [16]. These four factors appear to be generally accepted by researchers from this point forward,

and studies of rumor transmission continue to reference these four elements as primary factors of interest. The four factors are more completely described as follows:

General uncertainty is somewhat a redefinition of Allport and Postman's *ambiguity*. Rosnow justifies this reconceptualization by explaining that the term *uncertainty* more correctly defines the doubt or disbelief associated with a dissonance between a capricious event and the individual's interpretation of the event.

Outcome-relevant involvement is another reconceptualization by Rosnow that he justifies by first stating that a relationship between importance and rumor transmission has not been shown. In fact, some cases show an inverse relationship. Supported by the studies of Kurt Back and Joseph Scanlon, Rosnow adds that what Allport and Postman meant by the term *importance* could be more accurately described as results that are relevant to the individual involved.

Personal anxiety was not disregarded by Allport and Postman even though it wasn't included in their mathematical model. In fact, they suggested that this 'emotional tension' can induce the perceived ambiguity (uncertainty) experienced by the individual. As described by Allport and Postman, an unwillingness to accept reported facts, and therefore doubt, can cause the anxiety. This leads to the fourth factor.

Credulity is based on Allport and Postman's recognition that there is often at least a kernel of truth to every rumor. They went so far as to suggest that this bit of truth was necessary for triggering rumor transmission, thus making it a prerequisite. If one were to think of the consequences of passing on false rumors, it can be surmised that, in order to save one's reputation, only rumors deemed trustworthy would be transmitted.

### **Developing The Models**

Although much of the literature opines the lack of rumor analysis, many studies have been conducted to define relational models both before and after Rosnow proposed the four factors. An attempt will be made here to develop a mathematical representation of rumor transmission, as begun by Allport and Postman, describing the factors that influence rumor transmission and any interactive factors as well. Concurrently, a similar model will be developed to represent the influence of the individuals involved. The studies will be addressed in roughly chronological fashion to show how the model is built upon over the progress of time.

Before a rumor can be passed on, it first must be heard, therefore knowing under what conditions rumors are heard is valuable to the understanding of rumors. In 1973, research was conducted using a standard anxiety test and high school students to determine who hears rumors. It was shown that those who hear rumors are typically more anxious than those who do not [4]. We now can begin to describe the people types as identified by Sutton and say that isolates, those who do not hear the rumors, are generally less anxious than the remainder of the rumor public. We can show in a functional relationship that the likelihood of hearing a rumor is positively related to the person's anxiety:

$$H = f(A) \tag{5}$$

where  $H$  is the likelihood of hearing a rumor and  $A$  is the anxiety of the individual. Once heard, a rumor may or may not be spread. A model describing rumor transmission must be developed separately as transmission is a different event, predicated by first hearing the rumor.

A different study, using college students, reported that anxiety was positively related to rumor transmission [12]. Committing to the same type of mathematical expression, the results of this study can be expressed as:

$$T = f(A) \tag{6}$$

where  $T$  is the transmission rate of rumors. Another field study among college students verified that the relationship of  $T$  to  $A$  was a positive one [17]. In other words, as the value of  $A$  increased, the value of  $T$  also increased. Furthermore, the relationship appeared to be linear, implying that exponential terms of  $A$  were not part of the relationship over the range of  $A$  studied. Of those who hear rumors, this would show that liaisons are likely more anxious than dead-enders. Combining the results of the two studies, we can list the people types in order of increasing personal anxiety: first are the isolates, then the dead-enders, and finally the liaisons. As we move forward with a model of rumor transmission, we must remember that the model will apply only to the 78% of the rumor public who are liaisons or dead-enders. The model does not apply to the 22% who are isolates.

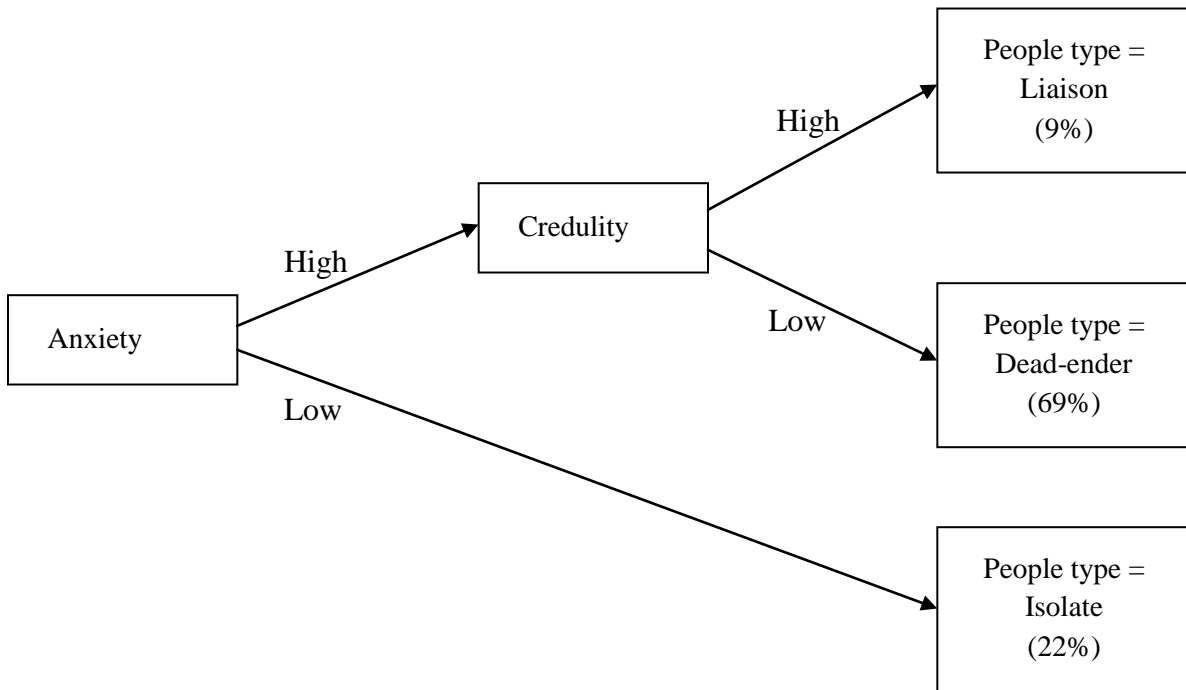
Rumor transmission is also positively related to the credulity of the rumor and credulity is positively related to belief [12]. The latter of these is fully anticipated because one would not expect belief to be inversely proportional to credulity since trusting and believing are intimately related. We therefore can expand our expression for rumor transmission to:

$$T = f(A,c) \tag{7}$$

where  $c$  is the credulity of the rumor as perceived by the person who hears it. For any given single rumor, if  $c$  was very low or did not exist, the person would become a dead-ender because the prerequisite of credulity would not have been met. This suggests that as the value of  $c$  approaches zero,  $T$  approaches zero as well and all other factors would become moot. We now can distinguish between each of the three people types based on anxiety and credulity, as shown in Figure 1. The credulity relationship is linear in both dread and wish rumors over the range of credulity studied [18]. Again, this suggests that exponential terms of  $c$  are not factors.

**FIGURE 1**

**Relationship of Anxiety and Credulity to People Type**



A relationship between uncertainty and transmission also exists [17]. To include this factor, the model can be expanded further:

$$T = f(A, c, u) \tag{8}$$

where  $u$  denotes uncertainty. Uncertainty is a stronger factor among dead-enders (lower anxiety) than liaisons (higher anxiety). Therefore, we must conclude that anxiety and uncertainty are interactive [9]. Accounting for this fact, the relational model must now show that transmission is a function of anxiety, credulity, uncertainty, and an interaction between anxiety and uncertainty. The relational model becomes:

$$T = f(A, c, u, Au) \tag{9}$$

where  $Au$  represents the interaction between anxiety and uncertainty.

The effect of outcome-relevant involvement seems to be less well-characterized in the literature. Although one study compared two sets of college students from different campuses and their

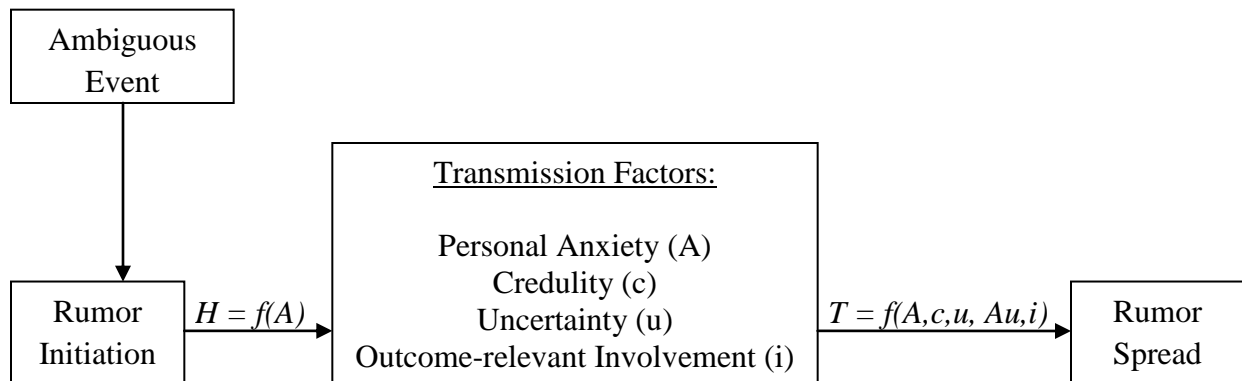
exposure to the rumor of a fatality on one of the campuses, they did not attempt to correlate importance to transmission [17]. Given that one set of students was from the campus on which the tragedy occurred and the other set was from a campus several miles away, one might think that outcome-relevant involvement could be inferred based on geographical relativity. Almost twice as many students on the affected campus transmitted the rumor than on the other campus (65% vs. 35%). If it can be said that the geographical relevance of the incident could be correlated to the outcome-relevant involvement of the rumor as perceived by the rumor recipient, then if this difference is significant for the population sizes measured, we could include outcome-relevant involvement in the functional expression. The functional relationship would become:

$$T = f(A, c, u, Au, i) \tag{10}$$

where we denote outcome-relevant involvement with  $i$ . It is unfortunate that the authors did not explore outcome-relevant involvement or importance as a factor in this study. It appears that the difference in transmission between the two campuses is significant, leaving open to exploration whether the geographical closeness of the campus could be related to outcome-relevant involvement. The final model of rumor transmission is shown in Figure 2.

**FIGURE 2**

**The Transmission of a Rumor**



**MANAGERIAL IMPLICATIONS**

The model developed thus far summarizes the factors studied and shown to have an impact on rumor transmission. To date, the coefficients of these factors are not known, and given the human qualities involved, cannot be expected to be pinpointed to exact values. What is useful is the relative importance of each factor based on the intensity of the coefficient for each. Knowing

what factors are most influential will help management be able to predict when rumors may spiral out of control quickly and when they may have some measure of time to react.

At this point, without these coefficients, what we can state is that each of the four factors has been shown to be positively related to rumor transmission. Additionally, we can state that one interactive factor has been identified thus far: that between anxiety and uncertainty. Other interactive terms have not yet been identified, but are allowed for in the model if they should be found in the future. Although linearity is frequently proposed in the studies, it should be noted that the apparent linearity can be applied only over the range covered within the respective studies. Some studies may suggest curvilinear effects, but that, too, is over the range studied.

Studies covering the full range of any one factor from nil to a stated maximum have not been done. It may be impractical to impart an artificially high level of a certain factor for the purposes of study. For example, it would be impractical to induce very high levels of anxiety if that level of anxiety is not seen by organizational managers in practice. While it may be of fascinating interest to researchers, it may be of little use to managers.

### **FUTURE RESEARCH**

Several areas of future rumor research are desired to clarify the models proposed here. First, there is a need for further exploration of Allport and Postman's factor of importance and whether it indeed exists as a separate and distinct factor from the four proposed by Rosnow. The fact that *importance* has been shown in the literature to be at times proportionately related and at times inversely related to rumor transmission begs further exploration to determine if what we are lacking is auxiliary factors or simply a clarification in definition.

Additionally, even though grapevine information has been shown to be rather accurate, factors affecting the accuracy of rumor transmission is an important area in which to expand research. Knowledge about what kind of people accurately transmit rumors and under what circumstances is particularly useful when an organization utilizes the grapevine for transmission of information.

As can be seen in this review, many studies are conducted using students, whether in field studies or in formulated experiments. Studies are needed to determine whether student populations are uniquely different from organizational populations. If so, more studies should be conducted in organizational contexts to increase the relevance of the research for managers.

Finally, very little research has been done on the factors that influence the likelihood that one will hear a rumor, thus yielding a very simplistic model for hearing a rumor. Further research into the factors that influence hearing a rumor will be helpful in further development of this model.

### **CONCLUSION**

The contemporary literature focusing on factors that affect rumor transmission can be brought together under one relational model that allows for expansion as further studies are conducted. Furthermore, the model allows for coefficients that describe the relative strength of each factor, which may be shown to be variable under certain conditions. The model, because it describes rumor transmission, does not apply to isolates, but does apply to the other 78% of the rumor



public: the liaisons and the dead-enders. To distinguish isolates from those who pass on rumors, a second model can be used to describe the likelihood of hearing a rumor, which is a prerequisite for transmitting a rumor.

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## **INCOME GROWTH AND SPENDING**

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## **ABSTRACT**

This research will focus on whether spending increases or decreases as a percentage of income by adopting a regressive model to analyze aggregate data from the Bureau of Labor Statistics. The aggregate data were collected from 1984 to 2007. Research results found that for most necessities, expenditures (housing, food, healthcare, and entertainment) as a percentage of income decreased as income increased. This behavior was demonstrated across several age groups, races, and occupations.

## **AMERICANS' SPENDING BEHAVIOR**

Americans' spending behavior is one of the most sought out and researched topics in the business world. People from marketing gurus to renowned psychologists, economists, corporations, and world leaders are interested in grasping and truly understanding the way Americans spend. Thousands of articles have been written to explain this behavior. Some have argued that "while income has generally been the most widely used behavioral indicator in marketing, social-class membership provides a richer dimension of meaning."<sup>[4]</sup> While others believe that, "what millions of Americans acquire and own is tightly bound to their personal identity" <sup>[5]</sup>

What is it that makes the topic of Americans' spending behavior so interesting to so many? First, it is important to recognize that today America, and the entire world for that matter, is facing an economic problem. The United States' impact as the world's largest consumption market proves that there is a strong correlation between the way Americans spend and the current economic problem we are facing. Secondly, marketing firms and corporations nationally and internationally depend on the understanding of Americans' spending behavior in order to make their next move to increase their market share. These are just a few examples that illustrate the importance of this topic.

While this research does not propose to provide the one and only correct answer to this incognita, it suggests a model that can aid in the understanding of Americans' spending behavior.

## **ECONOMIC PROBLEM**

This research will focus on consumption or spending as an economic problem. More specifically, the research is recognizing Americans' spending behavior as an economic problem. "America's families are caught in a perfect storm. Massive amounts of debt, falling house prices, disappearing jobs, flat wages, lower benefits, and skyrocketing costs for the most important consumer items are quickly emptying the pockets of middle class America and bringing many families to the edge of financial ruin." [9]

In the efforts of further understanding the importance of spending in the United States, three topics were researched:

1. Defining Economic Security
2. Understanding debt's impact on low- and middle-class households
3. Recognizing our Government's spending behavior

### **Defining Economic Security**

Before identifying consumption as an economic problem, it is important to define the most basic household needs that lead to economic security. For a family to be economically secure, they need:

1. A steady and predictable income to pay for basic needs;
2. Savings and assets such as a car—possible only when income allows a family to more than simply "get by;"
3. "Human and social capital (including education, experience, skills and professional networks) to obtain better-paying jobs." [1]

How well American households understand these three basic principles will determine the ability of that household to make the wisest decisions regarding consumption. Unfortunately, for most Americans, the list of items that determine economic security extends to a long list of wants and desires that are viewed as basic needs, often times dictated by the "Joneses".

## **Understanding Debt's Impact on Low- and Middle-Class Households**

The amount of debt is increasing for low income families. "Family debt has become an increasingly large burden for many low-income families in recent years. Total debt in these families is equal to nearly half of total annual family income." [7] Additionally, America's middle class is drowning in debt. The middle class is composed of households with incomes roughly from \$25,000 to \$70,000 a year. "In 2004, the typical family spent more than 18% of its income on debt payments." [8] Though this paper does not focus on debt, but rather the total consumption behavior and its relationship to income, it cannot ignore the fact that debt is one very important tool to measure consumption behavior.

A well managed debt is a healthy sign of a mature consumption behavior in a household. It is the overwhelmingly high debt ratios that lead to a breakdown in a household's spending behavior and ultimately to a financial crisis.

## **Recognizing Our Government's Spending Behavior**

The U.S. Federal Government collected \$2.52 trillion in FY2008, while spending \$2.98 trillion, generating a total deficit of \$455 billion. This type of spending behavior sets a trend for the rest of Americans to follow. In 1835, America was debt free for the first and only time. "At the end of 1834, Jackson reported in the State of the Union message that the country would be debt free as of Jan. 1, 1835, with a Treasury balance of \$440,000." [3] This further confirms the fact that the United States as a nation has demonstrated to its people the need for acquiring debt in order to attain its powerful status it now holds as the largest consumer market in the world.

After carefully reviewing these three topics the evidence suggested that in order to understand spending, there must be knowledge about what Americans are spending their money on. This research leads to the main question: Do Americans really spend more as their income increases?

### **HYPOTHESIS**

Our hypothesis is: As income increases, spending will increase as a percentage of income.

### **RESEARCH AND DATA COLLECTION**

"The clearest indicators of an improved standard of living are income levels and household expenditures." [2] The results from the Consumer Expenditure Survey (CES) [6] conducted by the Bureau of Labor Statistics (BLS) includes household spending as it relates to different categories such as age, race, income, housing tenure, and occupation. This household data is shown at the aggregate level and is presented yearly from 1984 to 2007. Though it is rather small in terms of number of observations (23 observation points), the data at the household level was not immediately available to include in our model.

## STATISTICAL ANALYSIS

### Analytical Tools

To analyze the statistical data from the BLS, two analytical tools were used. The first tool is KSTAT, or Kellogg Statistics package. KSTAT was used to determine relevant statistical information such as regression coefficients, p-values, and R<sup>2</sup> values for the overall analysis. The second tool used was Minitab, a leading statistical software package. Minitab was used to perform the multiple regression analysis.

### Variables of Study

As mentioned previously, there are several groups of study that are available from the CES data. However, some of the more recent groups had to be excluded from the study, due to the fact that these groups did not have statistical data from the entire history of the CES. Three groups were chosen for the analysis based upon the availability of a sufficiently large data set as well as relevant groups of interest to this study.

The three groups of study are as follows:

1. Age of reference person, which divides reference persons into groups of Under 25 years, 26-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, and 75+ years.
2. Occupation of reference person, which divides reference persons as Self-Employed, Managers/Professionals, Technical Sales/Clerical Workers, Service Workers, Operators/Laborers, and Retirees.
3. Race of reference person, which divides reference persons as White or Black.

Within each group there exist many expenditure categories varying from basic expenditures, such as food and clothing, to more detailed ones, such as charitable donations and household furnishings. For the purposes of this research, four basic expenditure categories were used. These categories were chosen based upon the commonality of these categories to the average U.S. citizen.

The four expenditure categories of study are as follows:

1. Food—this consists of all food-related expenditures such as breads, meats, fruits, vegetables, dairy products, as well food away from home (i.e. restaurants).
2. Housing—this consists of all housing-related expenditures such as mortgage payments and interest, property taxes, repairs, insurance, and rent.
3. Healthcare—this consists of all healthcare-related expenditures such as health insurance, medical services and supplies, and pharmaceutical drugs.
4. Entertainment—this consists of all entertainment-related expenditures such as admissions and fees, A/V equipment (i.e. TV's, stereos, etc.), pets, hobbies, and other assorted entertainment expenditures.

## Analysis Assumptions

The statistical analysis was based upon three relevant assumptions, noted below:

1. Dollars were not adjusted for inflation. That is, there was no conversion using a net-present-value (NPV) calculation. Since this analysis is based upon annual expenditures as a percentage of annual income, which is unaffected by a NPV calculation, it was determined that the NPV calculation would be superfluous and thus it was not performed.
2. Annual income for each category gradually increased over time. Economic effects over time, such as a recession and/or layoffs within an industry, were not considered.
3. A 5% level of significance was used for all statistical relevancy determinations. Any statistical data that did not meet these criteria were not subjected to further statistical analysis.

## ANALYTICAL DATA

Multiple linear regressions were performed on each group and on each category. Altogether, 12 multiple regressions were ran. (See Charts 1-12 in Appendix)

### Age

After performing the regression, the regression coefficients were obtained. The R<sup>2</sup>, P-value, and analysis of variances were also evaluated. The results are displayed in Figures 1-4 in Appendix. For each group and category set, as the income increased, the percentage of income spent decreased, except for the entertainment group. From this, the income elasticity of demand was calculated using Equation 1. (See results in Tables 1-4 in Appendix)

$$e = \left( \frac{\partial Q}{\partial I} \right) \left( \frac{I}{Q} \right) \quad (1)$$

For each category the income elasticity of demand was between 0.1 and 1, except for the entertainment category. For the entertainment category, the elasticity varied from 0 to 3. For the Age 25 and under group the elasticity was close to 3, while for the Age 65 and above group the elasticity was 0.

### Race

Multiple linear regressions were performed for each category in the race group. The results can be found in Figures 5-8 in Appendix. For each category, the slope was negative and as income increased, the percentage of income spent decreased. Then, income elasticity of demand was calculated using Equation 1 (See results in Tables 5 in Appendix) and yielded results from 0.01 to 0.85.

## **Occupation**

Multiple linear regressions were performed for the occupation group as well. The results can be found in Figures 9-12 in Appendix. Within the entertainment, housing, and healthcare categories, the retirees group behaved differently. For the retirees group, as income increased, the percentage of income spent increased. However, when the income elasticity of demand was calculated, the results were from 0.01 to 0.75. (See results in Tables 6-9 in Appendix)

## **ANALYTICAL RESULTS & FINDINGS**

Now that the statistical analysis has been performed, the results should provide evidence to support or refute the hypothesis. The hypothesis is that as income increases, spending as a percentage of income increases.

### **Hypothesis Result**

After running the statistical analysis, the majority of the categories resulted in the opposite of the formulated hypothesis. Predominantly, as income increased, spending as a percentage of income spent decreased. However, exceptions were found in certain categories.

In the category of “Entertainment”, for age groups 65-74 and 75 and over, percentage of income spent did increase as income increased. This difference is attributed to the status and behavior of the two age groups. For instance, the age groups listed above include those that have most likely paid off their mortgages. The freedom of not having a mortgage and having more disposable income possibly leads to increased spending in the entertainment category.

Retirees in the categories of Entertainment, Healthcare, and Housing support the hypothesis. Retirees may spend more on healthcare because they may no longer have the type of medical coverage that a job afforded them, and retirees are more likely to have health issues as age progresses. Additionally, retirees with more time and money at their disposal may be more likely to spend more on entertainment.

There are instances where the hypothesis is supported by the results; overall, there is not enough evidence to support the hypothesis. Therefore, the hypothesis cannot be accepted.

### **Sources of Error**

As a result of the small sample size ( $n < 30$ ), and the inability to obtain household-level data, the analysis was unable to create a clearer picture of the relationship between spending and income. Therefore, future analyses and data collection should be performed to remedy the issues that will be discussed in the next section.

## **Applications**

Earlier, Americans' spending behavior was identified as an economic problem. The importance of understanding this behavior was established, and a model was created to show the relationship between personal income growth and the change in spending as a percentage of income. Finally, there are some suggestions of ways this model can be used to address three areas that are impacted by the spending behavior of Americans.

Americans are said to be conspicuous consumers. That is to say that conspicuous consumers waste money and/or resources to display a higher status than others. Though these models do not clearly explain this behavior, with additional data, it could perhaps explain why spending as a percentage of income does not increase as income increases. For example, lower income groups may find themselves spending more of their income on things they cannot afford.

The models can further explain ways in which our nation can benefit in understanding Americas' spending behavior. For example, the government can gain understanding in the relationship between changes in income and spending. In terms of housing, our government could implement better strategies to encourage consumers who are willing and able to purchase a home to do so. At the same time, the government could impose tighter restrictions on lending companies that lend to consumers who are willing, but financially unfit to purchase a home.

With the United States being the largest consumer market in the world, these models can assist new and emerging international corporations to make their way into the US marketplace. For example, by understanding relationships between consumption and race, foreign investors can focus their marketing efforts according to their targeted race, thus allowing them to gain greater mark share in the US.

## **FUTURE ANALYSIS**

What is the next step in developing the data that has been gathered? It is important to continue the research and develop a model that more accurately represents Americans' spending behavior. In creating a more accurate model, it is important to recognize the areas that must be fortified.

### **Time and Money**

Because of time and money constraints, it was difficult to obtain the clearance needed to access the household-level data necessary for an appropriate sample size. As additional data is gathered at the household level, a more accurate model can be created to show how the percentages of spending and income levels interact with one another.

### **More Categories and Groups**

Adding more categories and groups will provide a more complete picture of where consumers' money is being spent and what percentage is being spent as their income increases.

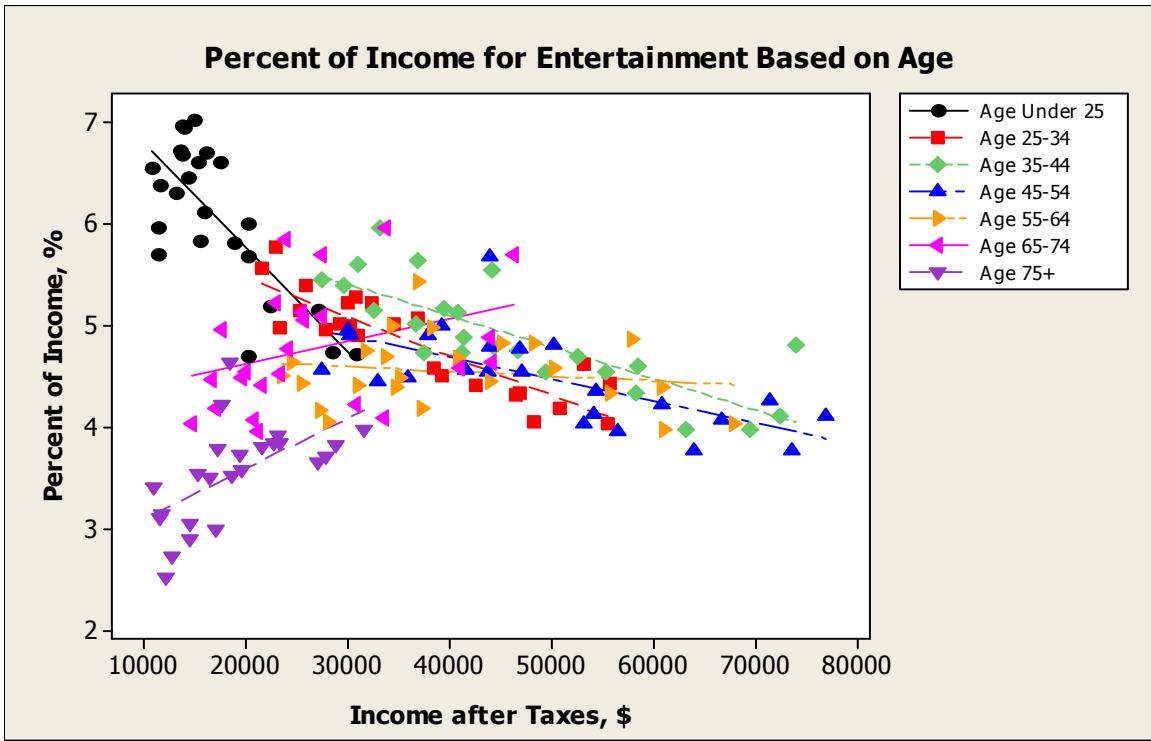


## **CONCLUSION**

As America's spending behavior was studied in order to determine if increased income led to increased spending as a percentage of income, this hypothesis was analyzed. However, the findings, in most instances, suggested that as income increased, spending as a percentage of income actually decreased. As more data is added to the base models, a greater and more in depth understanding of this powerful relationship between income growth and spending as a percentage of income should be gained. Additionally, there are several ways in which this data can provide insight regarding the way Americans consume. The information on how Americans spend at different financial stages is important on an individual level and a national level.

# APPENDIX

## Chart 1: Percentage of Income for Entertainment Based on Age



## Chart 2: Percentage of Income for Food Based on Age

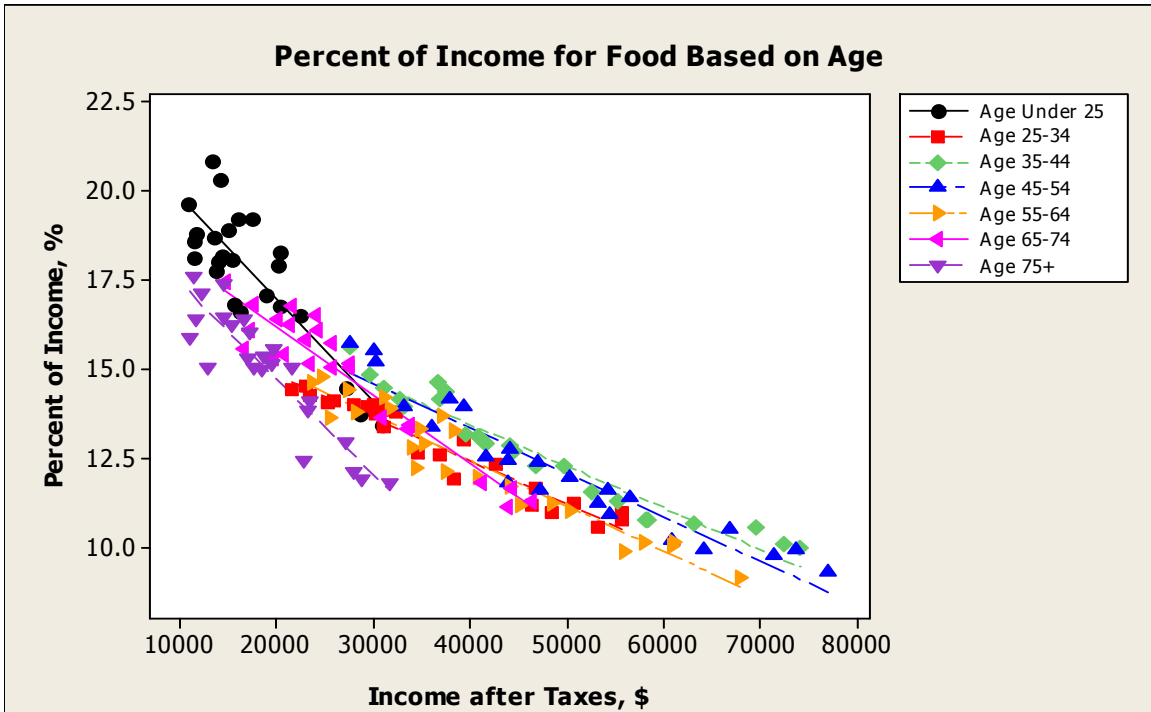


Chart 3: Percentage of Income for Healthcare Based on Age

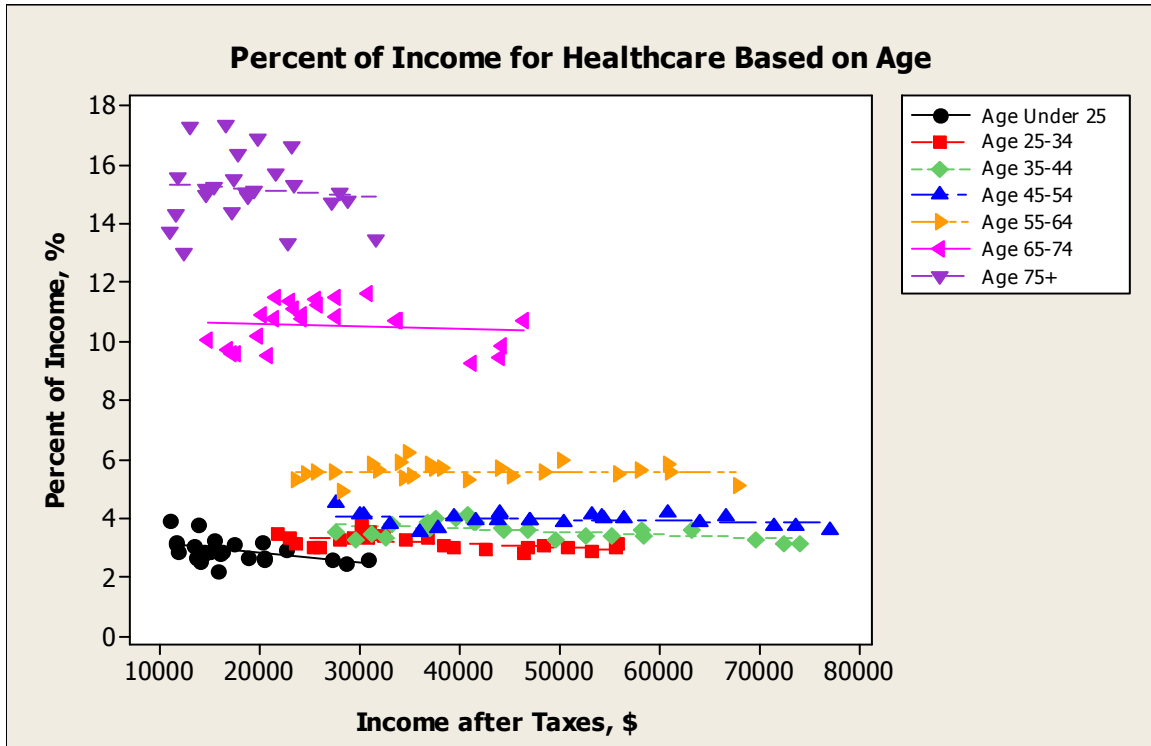


Chart 4: Percentage of Income for Housing Based on Age

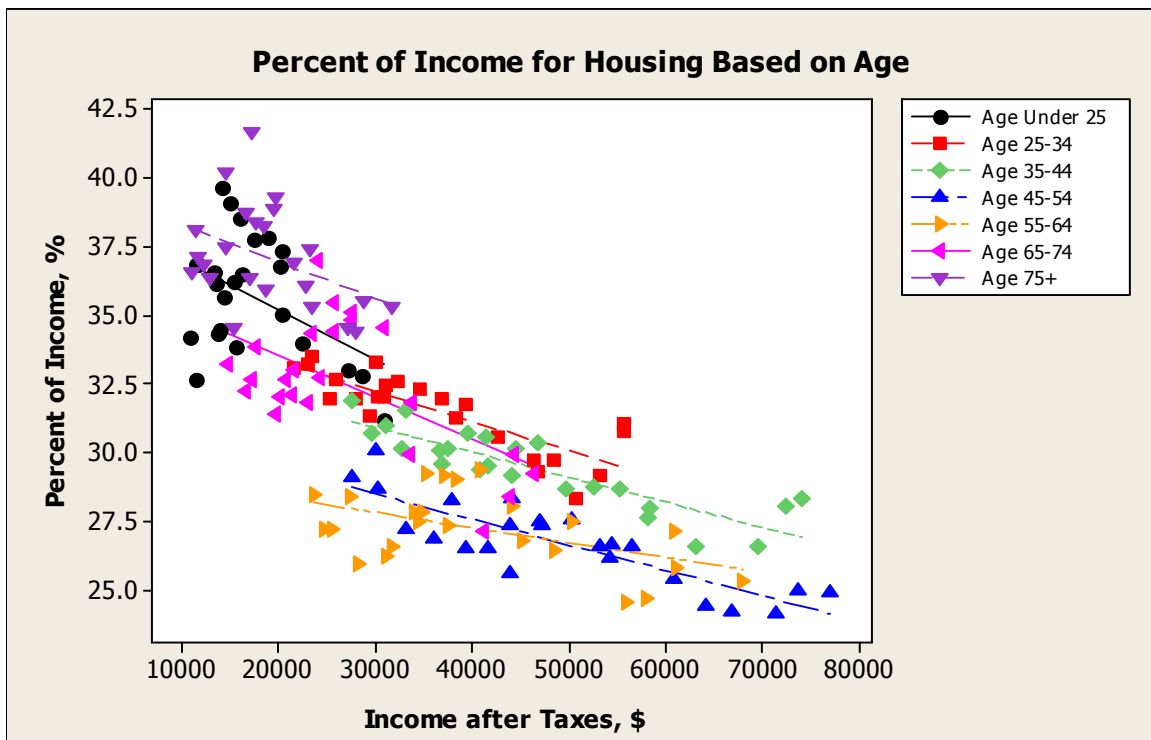


Chart 5: Percentage of Income for Entertainment Based on Race

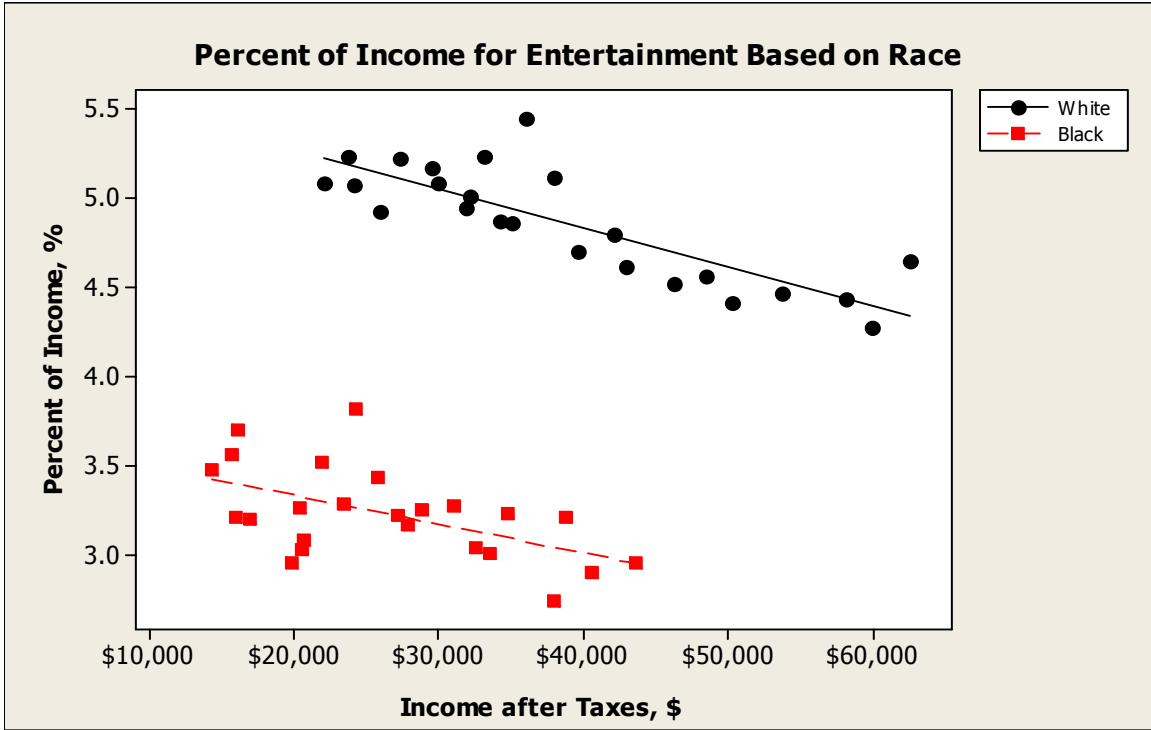
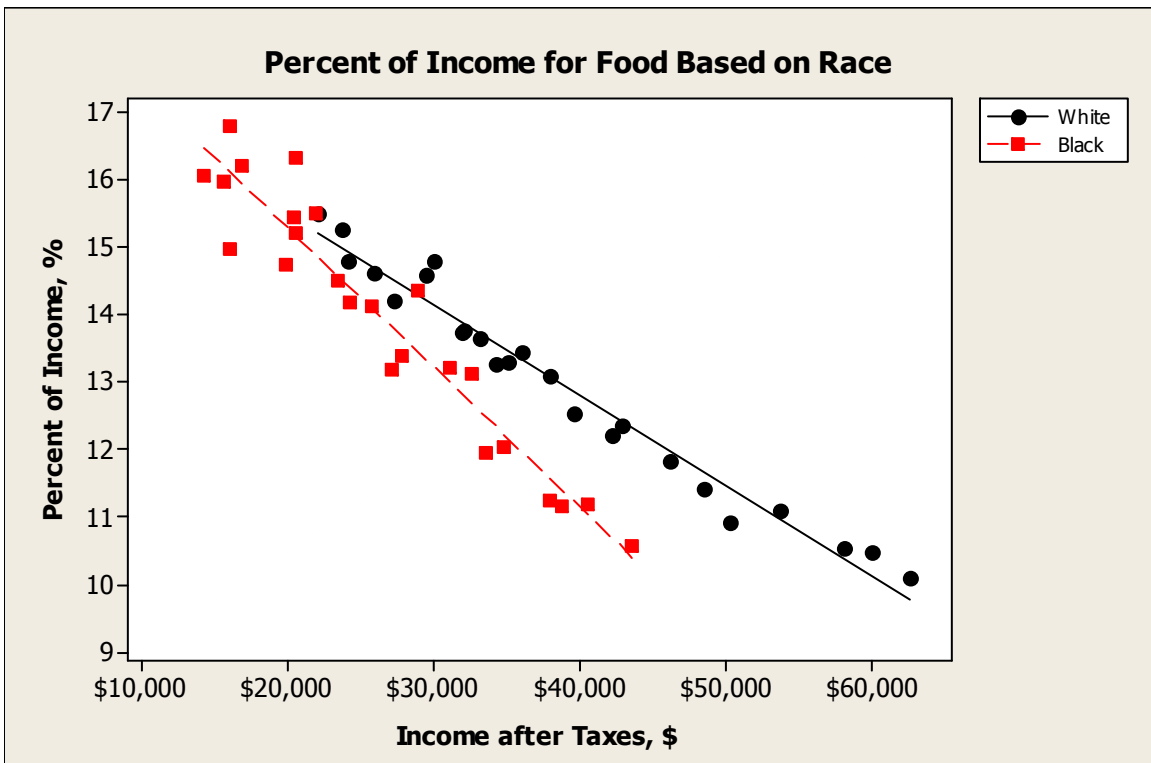
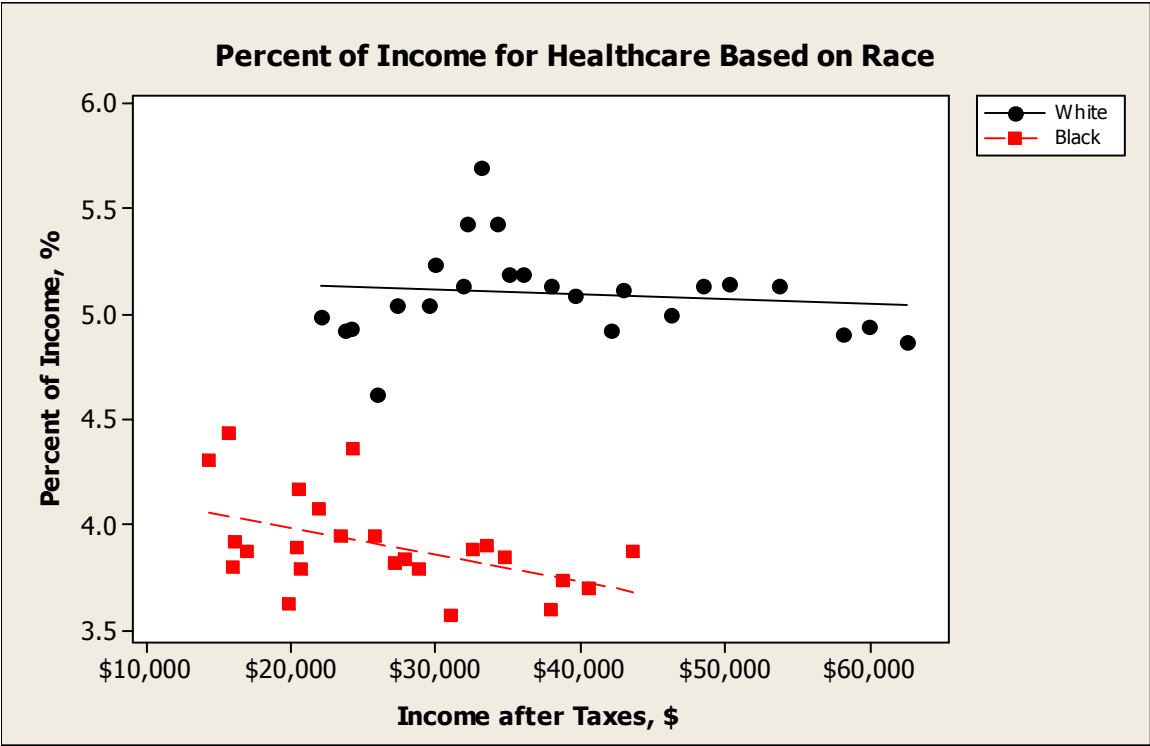


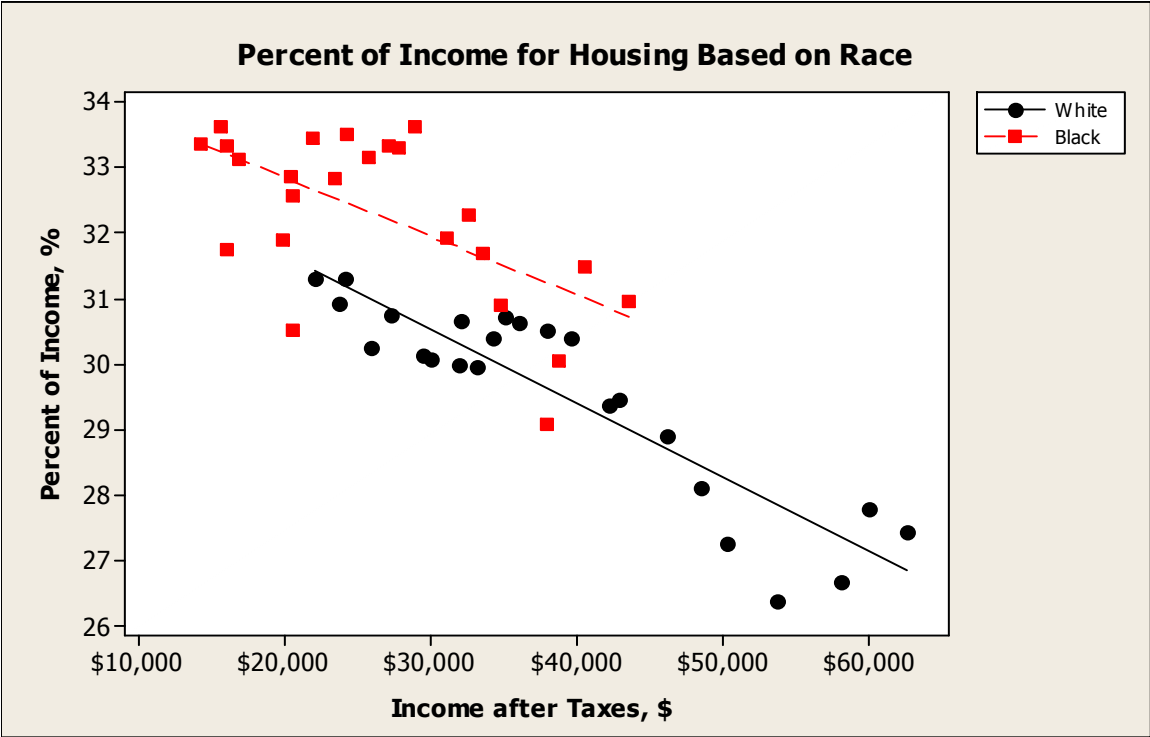
Chart 6: Percentage of Income for Food Based on Race



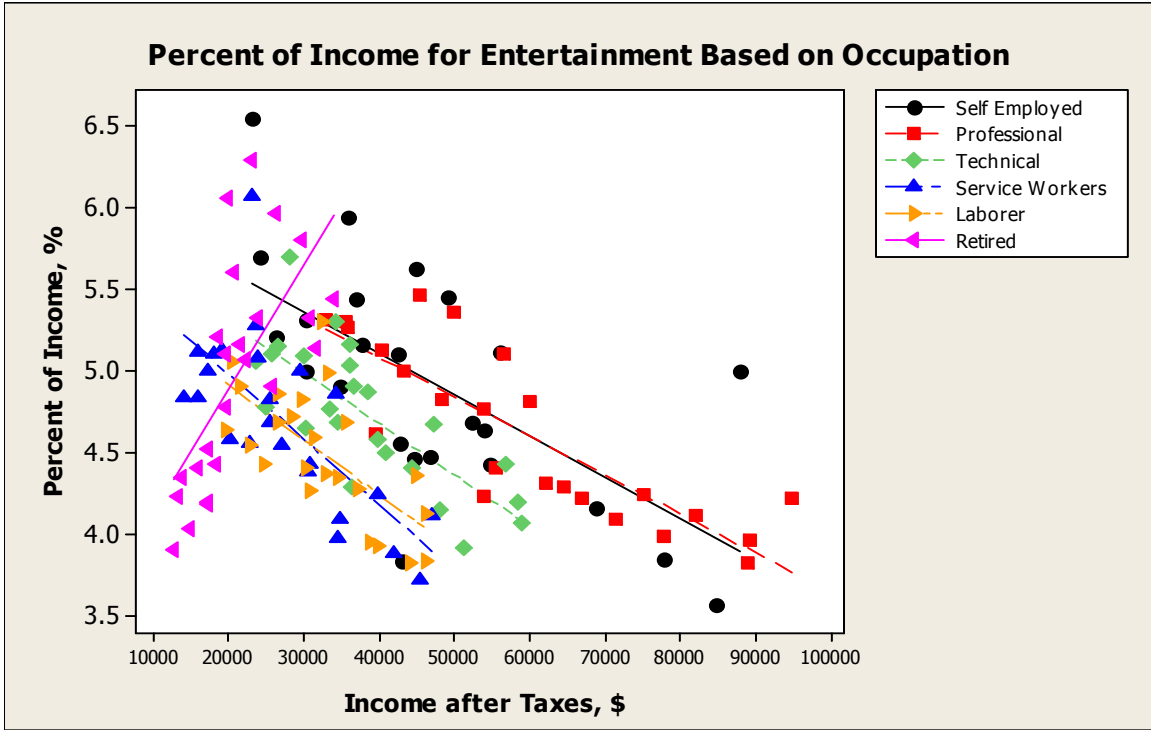
**Chart 7: Percentage of Income for Healthcare Based on Race**



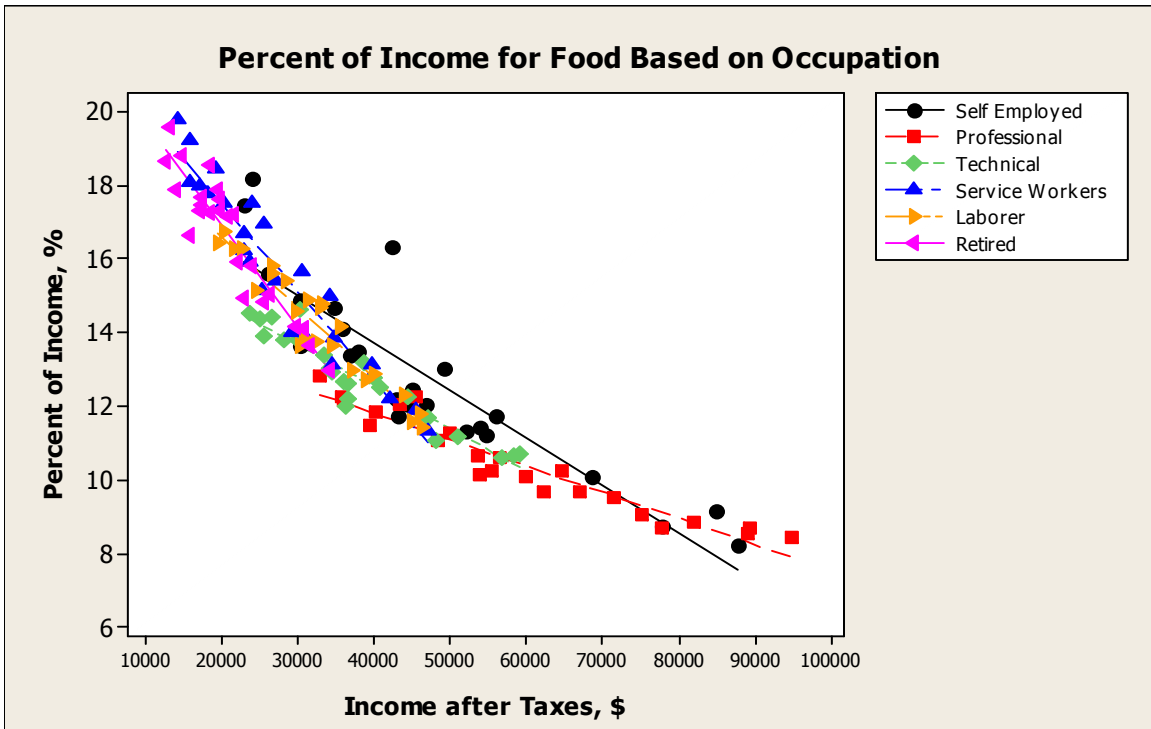
**Chart 8: Percentage of Income for Housing Based on Race**



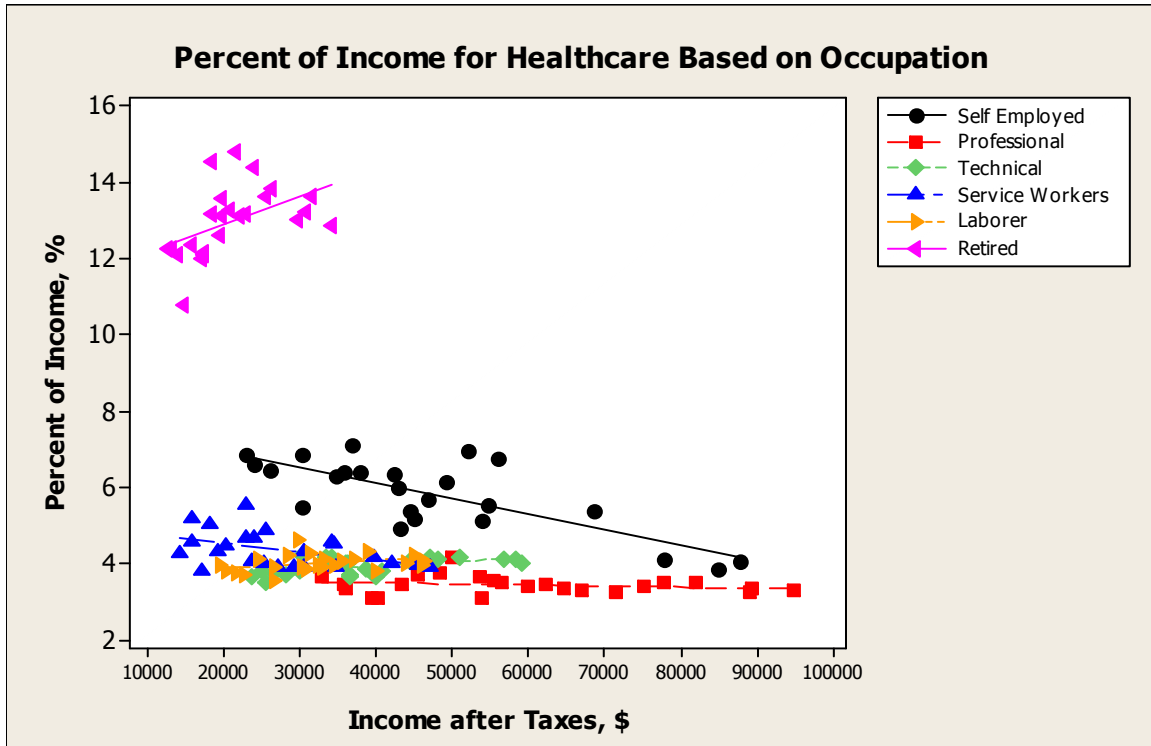
**Chart 9: Percentage of Income for Entertainment Based on Occupation**



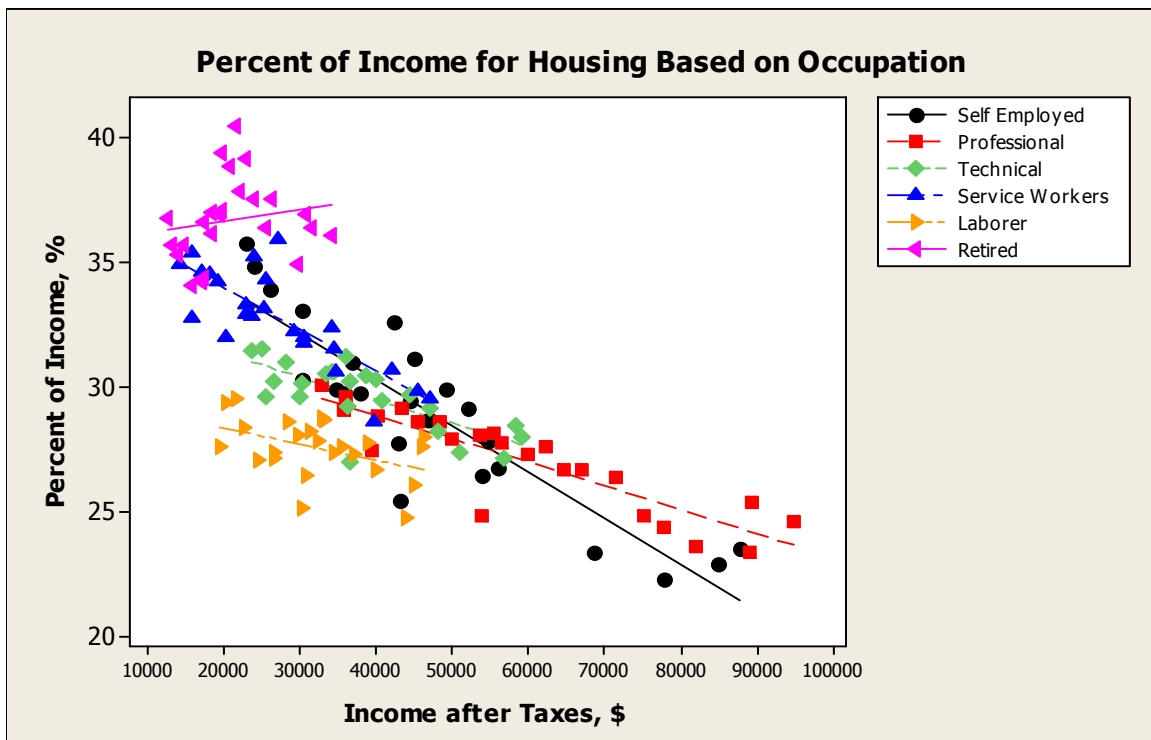
**Chart 10: Percentage of Income for Food Based on Occupation**



**Chart 11: Percentage of Income for Healthcare Based on Occupation**



**Chart 12: Percentage of Income for Housing Based on Occupation**



**Figure 1: Regression Analysis: Age – Entertainment**

Regression Analysis: Age - Entertainment					
The regression equation is					
Income % = 7.28 - 0.000109 Age Under 25 - 0.000036 Age 25-34					
- 0.00008 Age 35-44 - 0.000122 Age 45-54					
- 0.000196 Age 55-64 + 0.000303 Age 65-74					
+ 0.000202 Age 75+					
Predictor		Coef	SE Coef	T	P
Constant		7.2758	0.3805	19.12	0.000
Age Under 25		-0.00012548	0.00008761	-1.43	0.171
Age 25-34		-0.00003649	0.00008766	-0.42	0.683
Age 35-44		-0.0000075	0.0001007	0.07	0.942
Age 45-54		-0.00012169	0.00004727	2.57	0.020
Age 55-64		-0.00019597	0.00005834	-3.36	0.004
Age 65-74		0.00000270	0.00006506	0.04	0.967
Age 75+		0.0002016	0.0001029	1.96	0.068
S = 0.357576    R-Sq = 83.3%    R-Sq(adj) = 76.0%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	7	10.2098	1.4585	11.41	0.000
Residual Error	16	2.0458	0.1279		
Total	23	12.2556			
Source	DF	Seq SS			
Age Under 25	1	7.3945			
Age 25-34	1	0.0007			
Age 35-44	1	0.3547			
Age 45-54	1	0.9296			
Age 55-64	1	1.0378			
Age 65-74	1	0.0019			
Age 75+	1	0.4906			



**Figure 2: Regression Analysis: Age – Food**

Regression Analysis: Age - Food					
The regression equation is					
Income % = 19.0 - 0.000096 Age Under 25 - 0.000013 Age 25-34					
+ 0.000029 Age 35-44 - 0.000030 Age 45-54					
- 0.000046 Age 55-64 - 0.000021 Age 65-74					
- 0.000014 Age 75+					
Predictor		Coef	SE Coef	T	P
Constant		18.9506	0.2919	64.93	0.000
Age Under 25		-0.00009599	0.00006719	-1.43	0.172
Age 25-34		-0.00001279	0.00006723	-0.19	0.851
Age 35-44		0.00002891	0.00007725	0.37	0.713
Age 45-54		-0.00003016	0.00003625	-0.83	0.418
Age 55-64		-0.00004635	0.00004474	-1.04	0.316
Age 65-74		-0.00002096	0.00004990	-0.42	0.680
Age 75+		-0.00001446	0.00007893	-0.18	0.857
S = 0.274238    R-Sq = 97.9%    R-Sq(adj) = 96.9%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	7	55.0753	7.8679	104.62	0.000
Residual Error	16	1.2033	0.0752		
Total	23	56.2786			
Source	DF	Seq SS			
Age Under 25	1	53.0856			
Age 25-34	1	1.5693			
Age 35-44	1	0.0419			
Age 45-54	1	0.2167			
Age 55-64	1	0.1455			
Age 65-74	1	0.0138			
Age 75+	1	0.0025			

**Figure 3: Regression Analysis: Age – Healthcare**

Regression Analysis: Age - Healthcare					
The regression equation is					
Income % = 5.23 - 0.000115 Age Under 25 - 0.000071 Age 25-34					
+ 0.000161 Age 35-44 + 0.000006 Age 45-54					
+ 0.000080 Age 55-64 + 0.0000019 Age 65-74					
+ 0.0000018 Age 75+					
Predictor		Coef	SE Coef	T	P
Constant		5.2265	0.2921	17.89	0.000
Age Under 25		-0.00011544	0.00006725	-1.72	0.105
Age 25-34		-0.00007060	0.00006729	-1.05	0.310
Age 35-44		0.00016150	0.00007732	2.09	0.053
Age 45-54		0.00000625	0.00003628	0.17	0.865
Age 55-64		-0.00007984	0.00004478	-1.78	0.094
Age 65-74		0.00000053	0.00004994	0.01	0.992
Age 75+		0.00001795	0.00007900	0.23	0.823
S = 0.274476    R-Sq = 36.5%    R-Sq(adj) = 8.7%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	7	0.69330	0.09904	1.31	0.306
Residual Error	16	1.20539	0.07534		
Total	23	1.89869			
Source	DF	Seq SS			
Age Under 25	1	0.00056			
Age 25-34	1	0.02354			
Age 35-44	1	0.36558			
Age 45-54	1	0.02012			
Age 55-64	1	0.27958			
Age 65-74	1	0.00003			
Age 75+	1	0.00389			

**Figure 4: Regression Analysis: Age – Housing**

Regression Analysis: Age - Housing

The regression equation is

$$\begin{aligned} \text{Income \%} = & 32.3 + 0.000063 \text{ Age Under 25} + 0.000024 \text{ Age 25-34} \\ & + 0.000106 \text{ Age 35-44} + 0.000216 \text{ Age 45-54} \\ & + 0.000269 \text{ Age 55-64} + 0.000392 \text{ Age 65-74} \\ & + 0.000160 \text{ Age 75+} \end{aligned}$$

Predictor	Coef	SE Coef	T	P
Constant	32.3032	0.6139	52.62	0.000
Age Under 25	0.0000628	0.0001413	0.44	0.663
Age 25-34	0.0000236	0.0001414	0.17	0.870
Age 35-44	0.0001057	0.0001625	0.65	0.525
Age 45-54	0.00021649	0.00007626	2.84	0.012
Age 55-64	-0.00026867	0.00009412	-2.85	0.011
Age 65-74	-0.0003915	0.0001050	-3.73	0.002
Age 75+	0.0001597	0.0001660	0.96	0.351

S = 0.576888    R-Sq = 86.6%    R-Sq(adj) = 80.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	7	34.4506	4.9215	14.79	0.000
Residual Error	16	5.3248	0.3328		
Total	23	39.7753			

Source	DF	Seq SS
Age Under 25	1	23.6289
Age 25-34	1	0.1722
Age 35-44	1	0.0031
Age 45-54	1	1.0753
Age 55-64	1	4.7232
Age 65-74	1	4.5401
Age 75+	1	0.3077

**Figure 5: Regression Analysis: Race – Entertainment**

Regression Analysis: Race - Entertainment					
The regression equation is					
Income % = 4.76 - 0.000035 White - 0.000039 Black					
Predictor	Coef	SE Coef	T	P	
Constant	4.7583	0.1162	40.95	0.000	
White	-0.00004497	0.00002364	-1.90	0.071	
Black	0.00003879	0.00003264	1.19	0.248	
S = 0.150589    R-Sq = 67.4%    R-Sq(adj) = 64.3%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	2	0.98538	0.49269	21.73	0.000
Residual Error	21	0.47622	0.02268		
Total	23	1.46160			
Source	DF	Seq SS			
White	1	0.95336			
Black	1	0.03202			

**Figure 6: Regression Analysis: Race – Food**

Regression Analysis: Race - Food					
The regression equation is					
Income % = 18.6 - 0.000067 White + 0.000173 Black					
Predictor	Coef	SE Coef	T	P	
Constant	18.6449	0.2063	90.39	0.000	
White	-0.00001590	0.00004197	-0.38	0.709	
Black	-0.00017306	0.00005795	-2.99	0.007	
S = 0.267338    R-Sq = 97.8%    R-Sq(adj) = 97.5%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	2	65.337	32.668	457.10	0.000
Residual Error	21	1.501	0.071		
Total	23	66.838			
Source	DF	Seq SS			
White	1	64.699			
Black	1	0.637			

**Figure 7: Regression Analysis: Race – Healthcare**

Regression Analysis: Race - Healthcare					
The regression equation is					
Income % = 4.72 - 0.000007 White - 0.000005 Black					
Predictor	Coef	SE Coef	T	P	
Constant	4.7226	0.1232	38.33	0.000	
White	-0.00000739	0.00002507	-0.29	0.771	
Black	0.00000237	0.00003461	0.07	0.946	
S = 0.159676    R-Sq = 16.5%    R-Sq(adj) = 8.6%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	2	0.10596	0.05298	2.08	0.150
Residual Error	21	0.53542	0.02550		
Total	23	0.64138			
Source	DF	Seq SS			
White	1	0.10584			
Black	1	0.00012			

**Figure 8: Regression Analysis: Race – Housing**

Regression Analysis: Race - Housing					
The regression equation is					
Income % = 34.5 - 0.000152 White - 0.000187 Black					
Predictor	Coef	SE Coef	T	P	
Constant	34.4730	0.6050	56.98	0.000	
White	-0.0001518	0.0001231	-1.23	0.231	
Black	0.0000875	0.0001700	0.51	0.612	
S = 0.784076    R-Sq = 66.9%    R-Sq(adj) = 63.7%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	2	26.038	13.019	21.18	0.000
Residual Error	21	12.910	0.615		
Total	23	38.948			
Source	DF	Seq SS			
White	1	25.875			
Black	1	0.163			

**Figure 9: Regression Analysis: Occupation – Entertainment**

Regression Analysis: Occupation - Entertainment					
The regression equation is					
Income % = 5.36 - 0.000009 Self Employed					
- 0.000020 Professional - 0.000039 Technical					
- 0.000025 Service Workers - 0.000032 Laborer					
- 0.000037 Retired					
Predictor		Coef	SE Coef	T	P
Constant		5.3632	0.3866	13.87	0.000
Self Employed		-0.00000879	0.00001226	-0.72	0.483
Professional		-0.00002041	0.00002692	-0.76	0.459
Technical		-0.00003919	0.00003562	-1.10	0.287
Service Workers		0.00002464	0.00004390	0.56	0.582
Laborer		0.00003247	0.00004528	0.72	0.483
Retired		0.00003657	0.00006017	0.61	0.551
S = 0.212620    R-Sq = 63.1%    R-Sq(adj) = 50.1%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	6	1.31396	0.21899	4.84	0.005
Residual Error	17	0.76852	0.04521		
Total	23	2.08248			
Source	DF	Seq SS			
Self Employed	1	1.20087			
Professional	1	0.01330			
Technical	1	0.02223			
Service Workers	1	0.02897			
Laborer	1	0.03188			
Retired	1	0.01670			



**Figure 10: Regression Analysis: Occupation – Food**

Regression Analysis: Occupation - Food					
The regression equation is					
Income % = 20.2 - 0.000011 Self Employed					
- 0.000029 Professional - 0.000055 Technical					
- 0.000065 Service Workers + 0.000093 Laborer					
- 0.000043 Retired					
Predictor		Coef	SE Coef	T	P
Constant		20.2160	0.5891	34.31	0.000
Self Employed		-0.00001067	0.00001869	-0.57	0.575
Professional		-0.00002941	0.00004102	-0.72	0.483
Technical		-0.00005484	0.00005428	-1.01	0.327
Service Workers		0.00006506	0.00006690	0.97	0.344
Laborer		-0.00009280	0.00006900	-1.34	0.196
Retired		-0.00004348	0.00009169	-0.47	0.641
S = 0.324022    R-Sq = 97.4%    R-Sq(adj) = 96.4%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	6	65.571	10.928	104.09	0.000
Residual Error	17	1.785	0.105		
Total	23	67.356			
Source	DF	Seq SS			
Self Employed	1	62.106			
Professional	1	2.903			
Technical	1	0.225			
Service Workers	1	0.091			
Laborer	1	0.222			
Retired	1	0.024			

**Figure 11: Regression Analysis: Occupation – Healthcare**

Regression Analysis: Occupation - Healthcare					
The regression equation is					
Income % = 5.89 - 0.000052 Self Employed					
- 0.000030 Professional + 0.000036 Technical					
- 0.000037 Service Workers + 0.000099 Laborer					
+ 0.000015 Retired					
Predictor		Coef	SE Coef	T	P
Constant		5.8851	0.4409	13.35	0.000
Self Employed		-0.00005180	0.00001399	-3.70	0.002
Professional		-0.00002997	0.00003070	-0.98	0.343
Technical		0.00003552	0.00004063	0.87	0.394
Service Workers		0.00003684	0.00005007	0.74	0.472
Laborer		0.00009851	0.00005164	1.91	0.073
Retired		-0.00001542	0.00006862	-0.22	0.825
S = 0.242500 R-Sq = 57.9% R-Sq(adj) = 43.1%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	6	1.37556	0.22926	3.90	0.012
Residual Error	17	0.99971	0.05881		
Total	23	2.37527			
Source	DF	Seq SS			
Self Employed	1	0.15171			
Professional	1	0.80388			
Technical	1	0.18334			
Service Workers	1	0.02180			
Laborer	1	0.21186			
Retired	1	0.00297			

**Figure 12: Regression Analysis: Occupation – Housing**

Regression Analysis: Occupation - Housing					
The regression equation is					
Income % = 36.4 - 0.000033 Self Employed					
+ 0.000045 Professional + 0.000282 Technical					
+ 0.000236 Service Workers - 0.000034 Laborer					
- 0.000079 Retired					
Predictor		Coef	SE Coef	T	P
Constant		36.421	1.529	23.83	0.000
Self Employed		-0.00003253	0.00004849	-0.67	0.511
Professional		0.0000447	0.0001064	0.42	0.680
Technical		-0.0002821	0.0001408	-2.00	0.061
Service Workers		0.0002356	0.0001736	1.36	0.192
Laborer		-0.0000340	0.0001790	-0.19	0.852
Retired		-0.0000789	0.0002379	-0.33	0.744
S = 0.840680    R-Sq = 76.7%    R-Sq(adj) = 68.5%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	6	39.5327	6.5888	9.32	0.000
Residual Error	17	12.0146	0.7067		
Total	23	51.5473			
Source	DF	Seq SS			
Self Employed	1	35.1779			
Professional	1	0.1010			
Technical	1	2.8570			
Service Workers	1	1.2736			
Laborer	1	0.0454			
Retired	1	0.0778			

**Table 1: Elasticity for Entertainment based on Age**

<b>Age Under 25</b>	<b>Age 25-34</b>	<b>Age 35-44</b>	<b>Age 45-54</b>	<b>Age 55-64</b>	<b>Age 65-74</b>	<b>Age 75+</b>
0.34	0.42	0.46	0.03	0.27	0.01	0.00
0.31	0.45	0.48	0.03	0.27	0.01	0.00
0.34	0.47	0.49	0.03	0.28	0.01	0.00
0.35	0.52	0.50	0.04	0.30	0.01	0.00
0.44	0.54	0.51	0.04	0.29	0.01	0.00
0.44	0.61	0.53	0.04	0.32	0.01	0.01
0.41	0.66	0.53	0.04	0.33	0.01	0.01
0.42	0.72	0.54	0.05	0.34	0.01	0.01
0.46	0.69	0.55	0.05	0.34	0.01	0.01
0.52	0.70	0.56	0.05	0.35	0.01	0.01
0.51	0.73	0.56	0.05	0.36	0.01	0.01
0.55	0.78	0.56	0.05	0.35	0.01	0.01
0.45	0.89	0.58	0.05	0.36	0.01	0.01
0.49	1.00	0.58	0.05	0.37	0.01	0.01
0.54	1.09	0.59	0.06	0.38	0.01	0.01
0.62	1.15	0.60	0.06	0.41	0.01	0.01
0.71	1.38	0.62	0.06	0.40	0.01	0.01
0.81	1.71	0.63	0.06	0.43	0.01	0.01
0.80	1.75	0.64	0.07	0.43	0.01	0.01
0.80	1.92	0.64	0.07	0.46	0.01	0.01
0.98	2.22	0.66	0.07	0.47	0.01	0.01
1.48	2.61	0.68	0.08	0.48	0.02	0.01
1.68	3.10	0.69	0.08	0.48	0.02	0.01
2.10	3.12	0.70	0.08	0.51	0.02	0.01

**Table 2: Elasticity for Food based on Age**

<b>Age Under 25</b>	<b>Age 25-34</b>	<b>Age 35-44</b>	<b>Age 45-54</b>	<b>Age 55-64</b>	<b>Age 65-74</b>	<b>Age 75+</b>
0.06	0.02	0.04	0.05	0.06	0.02	0.01
0.06	0.02	0.04	0.05	0.06	0.02	0.01
0.06	0.02	0.05	0.05	0.07	0.02	0.01
0.06	0.02	0.05	0.06	0.07	0.02	0.01
0.08	0.02	0.05	0.06	0.07	0.02	0.01
0.08	0.02	0.05	0.06	0.08	0.02	0.01
0.07	0.02	0.05	0.07	0.08	0.02	0.01
0.07	0.02	0.05	0.07	0.09	0.02	0.01
0.08	0.02	0.06	0.07	0.09	0.02	0.01
0.09	0.02	0.06	0.07	0.09	0.03	0.01
0.08	0.02	0.06	0.07	0.10	0.03	0.01
0.09	0.02	0.06	0.08	0.09	0.03	0.01
0.08	0.02	0.06	0.08	0.10	0.03	0.01
0.08	0.03	0.06	0.09	0.10	0.03	0.01
0.09	0.03	0.07	0.09	0.11	0.03	0.01
0.10	0.03	0.07	0.09	0.12	0.03	0.02
0.11	0.03	0.07	0.09	0.12	0.03	0.01
0.11	0.03	0.08	0.10	0.13	0.04	0.02
0.11	0.03	0.08	0.11	0.14	0.04	0.02
0.11	0.03	0.08	0.11	0.16	0.04	0.02
0.13	0.04	0.09	0.12	0.16	0.05	0.02
0.16	0.04	0.10	0.13	0.17	0.05	0.02
0.17	0.04	0.10	0.13	0.17	0.05	0.02
0.18	0.04	0.10	0.14	0.20	0.05	0.02

**Table 3: Elasticity for Healthcare based on Age**

<b>Age Under 25</b>	<b>Age 25-34</b>	<b>Age 35-44</b>	<b>Age 45-54</b>	<b>Age 55-64</b>	<b>Age 65-74</b>	<b>Age 75+</b>
0.21	0.12	0.23	0.32	0.39	0.38	0.23
0.19	0.13	0.25	0.34	0.40	0.42	0.24
0.21	0.13	0.25	0.33	0.41	0.41	0.25
0.21	0.14	0.26	0.36	0.43	0.42	0.25
0.26	0.15	0.27	0.38	0.42	0.45	0.26
0.26	0.16	0.29	0.39	0.46	0.46	0.30
0.25	0.17	0.29	0.40	0.46	0.46	0.29
0.25	0.18	0.29	0.42	0.48	0.47	0.29
0.28	0.17	0.30	0.41	0.48	0.47	0.32
0.31	0.18	0.31	0.42	0.48	0.49	0.31
0.30	0.18	0.31	0.42	0.50	0.49	0.34
0.32	0.19	0.31	0.44	0.49	0.50	0.32
0.27	0.21	0.33	0.44	0.50	0.50	0.33
0.29	0.22	0.33	0.46	0.51	0.52	0.34
0.31	0.23	0.34	0.47	0.52	0.52	0.35
0.35	0.24	0.35	0.48	0.55	0.53	0.39
0.39	0.27	0.37	0.48	0.54	0.53	0.35
0.44	0.30	0.38	0.49	0.57	0.56	0.38
0.43	0.30	0.39	0.51	0.58	0.58	0.39
0.44	0.31	0.39	0.52	0.60	0.58	0.39
0.51	0.34	0.41	0.53	0.61	0.63	0.43
0.68	0.36	0.43	0.54	0.62	0.65	0.44
0.75	0.38	0.44	0.55	0.62	0.65	0.44
0.86	0.38	0.45	0.56	0.65	0.66	0.47

**Table 4: Elasticity for Housing based on Age**

<b>Age Under 25</b>	<b>Age 25-34</b>	<b>Age 35-44</b>	<b>Age 45-54</b>	<b>Age 55-64</b>	<b>Age 65-74</b>	<b>Age 75+</b>
0.02	0.02	0.08	0.16	0.16	0.15	0.12
0.02	0.02	0.09	0.17	0.17	0.17	0.12
0.02	0.02	0.09	0.17	0.18	0.17	0.12
0.02	0.02	0.10	0.18	0.19	0.18	0.13
0.03	0.02	0.10	0.19	0.19	0.19	0.14
0.03	0.02	0.11	0.20	0.21	0.20	0.16
0.03	0.02	0.11	0.21	0.21	0.20	0.15
0.03	0.02	0.11	0.23	0.22	0.21	0.15
0.03	0.02	0.11	0.22	0.22	0.21	0.17
0.03	0.02	0.12	0.23	0.22	0.22	0.17
0.03	0.02	0.12	0.23	0.24	0.22	0.18
0.03	0.02	0.12	0.24	0.23	0.23	0.17
0.03	0.03	0.13	0.24	0.24	0.23	0.18
0.03	0.03	0.13	0.25	0.24	0.24	0.18
0.03	0.03	0.13	0.26	0.25	0.24	0.19
0.03	0.03	0.14	0.27	0.27	0.25	0.22
0.04	0.03	0.15	0.27	0.27	0.25	0.19
0.04	0.03	0.15	0.27	0.29	0.27	0.21
0.04	0.03	0.16	0.29	0.30	0.29	0.22
0.04	0.03	0.16	0.30	0.32	0.29	0.22
0.04	0.04	0.17	0.31	0.33	0.33	0.25
0.05	0.04	0.19	0.32	0.34	0.35	0.25
0.05	0.04	0.19	0.33	0.34	0.35	0.26
0.06	0.04	0.20	0.34	0.36	0.36	0.28

**Table 5: Elasticity for Race Category**

White Entertainment	Black Entertainment	White Food	Black Food	White Healthcare	Black Healthcare	White Housing	Black Housing
0.19	0.13	0.09	0.12	0.03	0.02	0.11	0.08
0.21	0.15	0.09	0.13	0.04	0.02	0.12	0.10
0.22	0.15	0.10	0.13	0.04	0.02	0.12	0.09
0.24	0.15	0.10	0.13	0.04	0.02	0.13	0.10
0.25	0.16	0.11	0.14	0.04	0.02	0.14	0.10
0.28	0.19	0.12	0.16	0.05	0.02	0.15	0.12
0.28	0.20	0.12	0.16	0.05	0.02	0.15	0.13
0.31	0.20	0.13	0.16	0.05	0.02	0.16	0.13
0.31	0.20	0.13	0.16	0.05	0.02	0.16	0.12
0.32	0.22	0.14	0.17	0.05	0.02	0.17	0.13
0.34	0.24	0.14	0.18	0.05	0.03	0.18	0.15
0.35	0.25	0.14	0.18	0.05	0.03	0.18	0.15
0.36	0.27	0.15	0.19	0.06	0.03	0.19	0.16
0.39	0.29	0.16	0.20	0.06	0.03	0.20	0.17
0.41	0.30	0.17	0.21	0.06	0.03	0.21	0.18
0.45	0.31	0.18	0.21	0.07	0.03	0.23	0.19
0.46	0.34	0.18	0.22	0.07	0.03	0.23	0.20
0.51	0.36	0.20	0.23	0.07	0.04	0.26	0.21
0.55	0.40	0.21	0.24	0.08	0.04	0.27	0.23
0.59	0.38	0.22	0.24	0.08	0.04	0.28	0.22
0.65	0.45	0.24	0.26	0.09	0.04	0.31	0.26
0.75	0.47	0.26	0.27	0.09	0.04	0.34	0.27
0.79	0.50	0.28	0.27	0.10	0.04	0.36	0.28
0.85	0.56	0.29	0.29	0.10	0.05	0.38	0.31



**Table 6: Elasticity for Entertainment based on Occupation**

<b>Self Employed</b>	<b>Professional</b>	<b>Technical</b>	<b>Service Workers</b>	<b>Laborer</b>	<b>Retired</b>
0.04	0.14	0.21	0.07	0.13	0.09
0.04	0.15	0.23	0.08	0.14	0.10
0.05	0.15	0.22	0.08	0.15	0.11
0.05	0.17	0.24	0.09	0.16	0.11
0.05	0.18	0.26	0.09	0.17	0.12
0.06	0.19	0.28	0.10	0.19	0.13
0.06	0.20	0.28	0.10	0.19	0.13
0.08	0.25	0.36	0.12	0.22	0.14
0.07	0.22	0.32	0.12	0.20	0.14
0.07	0.23	0.36	0.12	0.22	0.15
0.08	0.25	0.34	0.13	0.22	0.16
0.08	0.26	0.33	0.13	0.23	0.16
0.08	0.27	0.36	0.13	0.24	0.16
0.08	0.29	0.35	0.16	0.24	0.17
0.09	0.30	0.39	0.14	0.26	0.18
0.10	0.32	0.41	0.17	0.25	0.19
0.10	0.33	0.42	0.17	0.27	0.17
0.09	0.36	0.48	0.19	0.28	0.20
0.10	0.39	0.52	0.19	0.30	0.21
0.10	0.41	0.54	0.19	0.31	0.22
0.13	0.44	0.59	0.23	0.36	0.26
0.15	0.50	0.71	0.24	0.37	0.27
0.17	0.50	0.75	0.27	0.38	0.28
0.17	0.55	0.74	0.28	0.38	0.31

**Table 7: Elasticity for Food based on Occupation**

<b>Self Employed</b>	<b>Professional</b>	<b>Technical</b>	<b>Service Workers</b>	<b>Laborer</b>	<b>Retired</b>
0.01	0.05	0.07	0.05	0.08	0.03
0.01	0.05	0.07	0.05	0.09	0.03
0.01	0.05	0.07	0.05	0.09	0.03
0.02	0.06	0.08	0.06	0.09	0.03
0.02	0.06	0.08	0.06	0.10	0.03
0.02	0.07	0.09	0.07	0.11	0.04
0.02	0.07	0.09	0.07	0.11	0.04
0.02	0.08	0.11	0.08	0.12	0.04
0.02	0.07	0.10	0.08	0.12	0.04
0.02	0.08	0.11	0.08	0.12	0.04
0.02	0.08	0.10	0.09	0.12	0.04
0.02	0.09	0.10	0.08	0.13	0.04
0.03	0.09	0.11	0.09	0.13	0.04
0.02	0.09	0.11	0.10	0.13	0.05
0.03	0.10	0.12	0.10	0.14	0.05
0.03	0.10	0.12	0.11	0.13	0.05
0.03	0.11	0.13	0.11	0.14	0.05
0.03	0.11	0.14	0.13	0.15	0.05
0.03	0.12	0.15	0.12	0.15	0.06
0.03	0.13	0.15	0.12	0.15	0.06
0.04	0.13	0.16	0.15	0.17	0.07
0.04	0.15	0.18	0.16	0.17	0.07
0.05	0.15	0.19	0.17	0.18	0.07
0.05	0.16	0.19	0.18	0.18	0.08

**Table 8: Elasticity for Healthcare based on Occupation**

<b>Self Employed</b>	<b>Professional</b>	<b>Technical</b>	<b>Service Workers</b>	<b>Laborer</b>	<b>Retired</b>
0.17	0.14	0.13	0.08	0.25	0.03
0.17	0.15	0.14	0.09	0.25	0.03
0.19	0.15	0.13	0.09	0.27	0.03
0.21	0.17	0.14	0.10	0.28	0.04
0.21	0.17	0.15	0.10	0.29	0.04
0.24	0.18	0.15	0.11	0.31	0.04
0.23	0.19	0.16	0.11	0.31	0.04
0.27	0.22	0.18	0.13	0.34	0.04
0.25	0.20	0.17	0.13	0.32	0.04
0.24	0.20	0.18	0.13	0.34	0.04
0.27	0.21	0.17	0.14	0.33	0.05
0.28	0.22	0.17	0.13	0.34	0.05
0.28	0.22	0.18	0.14	0.35	0.05
0.27	0.23	0.18	0.16	0.36	0.05
0.29	0.24	0.19	0.15	0.37	0.05
0.32	0.25	0.20	0.16	0.36	0.06
0.33	0.25	0.20	0.16	0.37	0.05
0.30	0.27	0.21	0.18	0.38	0.06
0.32	0.28	0.22	0.18	0.39	0.06
0.33	0.28	0.23	0.18	0.40	0.06
0.38	0.29	0.24	0.20	0.42	0.07
0.41	0.31	0.26	0.21	0.43	0.07
0.43	0.31	0.27	0.22	0.44	0.07
0.44	0.33	0.26	0.23	0.44	0.08

**Table 9: Elasticity for Housing based on Occupation**

<b>Self Employed</b>	<b>Professional</b>	<b>Technical</b>	<b>Service Workers</b>	<b>Laborer</b>	<b>Retired</b>
0.02	0.04	0.15	0.08	0.02	0.03
0.02	0.04	0.17	0.09	0.02	0.03
0.02	0.04	0.16	0.09	0.02	0.03
0.03	0.05	0.17	0.10	0.02	0.03
0.03	0.05	0.18	0.10	0.02	0.04
0.03	0.05	0.19	0.11	0.03	0.04
0.03	0.05	0.19	0.12	0.03	0.04
0.04	0.06	0.22	0.13	0.03	0.04
0.04	0.06	0.21	0.13	0.03	0.04
0.03	0.06	0.22	0.13	0.03	0.04
0.04	0.06	0.21	0.14	0.03	0.04
0.04	0.06	0.21	0.13	0.03	0.04
0.04	0.07	0.22	0.14	0.03	0.04
0.04	0.07	0.22	0.16	0.03	0.05
0.04	0.07	0.23	0.15	0.03	0.05
0.05	0.07	0.24	0.17	0.03	0.05
0.05	0.08	0.24	0.17	0.03	0.05
0.05	0.08	0.26	0.18	0.04	0.05
0.05	0.08	0.27	0.18	0.04	0.06
0.05	0.09	0.27	0.18	0.04	0.06
0.07	0.09	0.28	0.20	0.04	0.07
0.08	0.10	0.31	0.21	0.04	0.07
0.08	0.10	0.31	0.23	0.04	0.07
0.09	0.10	0.31	0.23	0.05	0.08

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# Variable Rectangle Strip Cutting Heuristic Analysis – a Real World Implementation

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## **Abstract**

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In production manufacturing, waste diminution and material optimization plays a significant role in capacity planning, cost reduction, and resource utilization. In industries where raw materials are cut from strip or stock, nesting interior cuts can substantially reduce waste while increasing capacity.

In this paper, we devise and implement an arrangement for variably oriented rectangles to be cut from a strip of raw material, such that it addresses the problem of minimizing waste by nesting rectangular cut-patterns.

In doing so, we will (1) introduce Strip Cutting and Bin Packing problems, (2) explore various algorithms and heuristics, (3) demonstrate a heuristic approach in order to comprehend the problem, (4) formulate and demonstrate our own methodology, and finally (5) present our finding.

## **Keywords**

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Stock Cutting, Strip Packing, 2-D Bin Packing, Bottom-Left Heuristic, Top-Left Heuristic

## **Introduction**

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Strip packing or stock cutting is a familiar topic in manufacturing and industrial engineering disciplines. Production managers often focus on reduction of cost and increase in capacity by minimizing waste and maximizing raw material usage. This implies that managers must derive a number of partitions from a stock of raw materials, so that it can be portioned in such a manner that the final arrangement reduces waste. This is especially true for of glass, furniture, and fabric industries, where the end product is a variable of the original stock.

Furthermore, waste can be produced as a result of uncomplimentary product specs – i.e. customer

specifications that do not give way to an optimized execution plan. Given the workload, it may be impossible to arrange items without producing waste. For example, if a furniture production plant has 2' x 20' pieces of stock, but the current production workload requires 30 pieces with 2' x 11' cuts, then 9' of the original stock will result in waste from each unit of raw material. The wasted raw material should be accounted for, and re-introduced into the system to be utilized when more items are sequestered with proper dimensional values.

This problem is not only localized to production facilities. In a fulfillment center, the maximization of space for cargo is crucial in remaining competitive while addressing logistical constraints. A cargo liner generates nearly the same cost when embarking full, as it does empty. While the variable is one of packing, rather than cutting, in principle they are the same problem. The more optimized the packing and the scheduling of the ship's cargo, the greater the stakeholder profit.

This optimization, in both methodologies, is often propagated by the utilization of some bin packing or knapsack related algorithm to schedule or arrange material or space usage. This topic has produced a great deal of research by theorists, scientists, and production managers alike. Many algorithmic approximations have been studied over the past 50 years in an attempt to resolve this issue (Coffman, et al., 1984)

A common method for packing rectangles is to take an ordered list of rectangles, and greedily place them onto the stock or space one by one. Perhaps, the best studied and most effective, such as heuristic, for the fixed-orientation variation is the Bottom-Left (BL) heuristic, where rectangles are sequentially placed first as close to the bottom and then as far to the left as they can fit. Recently, genetic algorithms, continuous (LP) relaxation, and Sequential Value Correction have been able to generate almost perfect solutions.

For this paper, we set out to do two things: first, to study and decompose the packing/cutting problem to gain an understanding of the problem and its proven solutions; but also, we will show a viable solution by developing production ready development code to display and approximate the actual results. This application would be a deliverable product and the primary objective of the stakeholder's investment. Our time period for research, design, development, and testing was less than two months, typical for a Software Development Life Cycle (SDLC). Our sponsor required the solution to be both accurate in result and deliverable with a reasonable time-to-shelf. Therefore our constraints were not only finding available solution, but also to deliver the solution under timeline.

In the first section we will layout the cutting/packing problem by defining the problem. The second section will layout some heuristics to resolving the problem. The third section will outline our approach to resolving the problem, while the final section will portray our findings and recommendations.

## Background

Lesh, Marks, McMahon, and Mitzenmacher's paper describes strip packing as a list of  $n$  rectangles with a dimensional width of  $w$  that must pack onto a single rectangle with Width of  $W$  and height of  $H$ , without overlap. Furthermore, the orientation of these rectangles cannot be orthogonally placed about the axis, rather, they must be aligned either at a horizontal or vertical axis – variably aligned with at most a 90 degree rotation. (Edmund Burke, May–June 2006) (Lesh, et al., 2005)

The paper mentions that the most common and expensive method to resolve the problem is to approach with a greedy algorithm – iterate through every combination possible for a set of *widths* and *heights*. This method is certainly taxing and has a potential to grow at  $N^3$  in complexity. Therefore, as the number of rectangles increase, the complexity rises exponentially and the performance reduces significantly.

So how can the stock cutting problem be resolved in order to produce a real world application within the constraints of time and resources? As Lesh, Marks, McMahon, and Mitzenmacher observe:

*The BL heuristic has been shown to be a 3-approximation when the rectangles are sorted by decreasing width; that is, the resulting height is always within a factor of 3 of optimal.(pg 2)* (Lesh, et al., 2005)

Given this observation, a heuristically approach can effectively (factor of 3) approximate an appropriate solution to the problem. Therefore we can approach it by either by using BL or pursuing a method that takes substantially more time but still only provide near

optimal solution. Genetic algorithms, gene-based adaptive mutations, simulated annealing, branch-and-bound algorithms generally solve the problem with a near perfect fit, yet variable-orientation and nested cuts can increase the breadth of the problem substantially (Lesh, et al., 2005). Also, these methodologies are complex and often require substantial resources to develop and maintain. Often third party toolkits or adaptors are needed to resolve these multivariate problems. It is for these reasons that in this paper we will mention and study complex optimization algorithms, but will only implement an approximation heuristic.

To answer our question of whether or not the problem can be solved with the creation of a real-world application, we will define Bin Packing and Stock Cutting methodologies, and follow by annotating each heuristic's approach to approximating to a viable solution.

## Rectangular Knapsack/Stock Cutting

In the context of this paper, we can denote our problem by defining other similar problems in academia. The primary goal is to minimize waste and maximize stock utilization. The traditional Knapsack problem or one/two dimensional stock-cutting best describe this primary goal of utilization. In this section we define the traditional knapsack problem and one/two dimensional stock cutting.

*Rectangular Knapsack:* in this problem we are given  $m$  items (types of rectangles), each item  $i$  of width  $w_i$ , height  $h_i$ , and value  $v_i$  ( $i = 1 \dots m$ ). We wish to determine how to cut the rectangle, so as to maximize the sum of the values of the items that are produced. (G. F. Cintra, 2007)

*One-Dimensional Stock Cutting:* is defined as the deduction of a *cutting plan* for available stock length from a required set of pieces in order to minimize the number of used stock lengths (Gilmore, et al., 1965)

*Two-Dimensional Two-Stage Constrained Cutting:* is described by placing a subset of rectangular pieces on a single rectangular raw stock. In two stage cutting, openings (cuts) produced in the first stage are cut into pieces to fit into the second stage. These pieces are constrained by the types and number of items that the pieces to be produced. (Gilmore, et al., 1965)(Belov, et al., 2000)

It's important to note that this solution considers a fixed vertical strip with the goal of minimizing the height needed to pack a given set of rectangular pieces. (G. F. Cintra, 2007)

**Available Resolution Algorithms**

Given our problem definitions in popular academia, we can now interpret the below heuristics to approximate viable resolutions. Below lists each heuristic with a brief description of its methodology.

*Next Fit (NF):* The current raw stock is used to place the next cut; otherwise this methodology inserts a new raw stock one and place the cut there.<sup>1</sup>

*First Fit (FF):* Considers the current raw stock in increasing order and places the new cuts in the first one where it fits.<sup>1</sup>

*Best Fit (BF):* It places the cuts on the current raw stock where it best fits, that is, in the stock that leaves minimum waste.<sup>1</sup>

*Worst Fit (WF):* It places the cut in the current stock where it worst fits (with the largest available waste).<sup>1</sup>

*Almost Worst Fit (AWF):* It places the cut in the current stock with the second largest available waste.<sup>1</sup>

*Bottom-Left Heuristic:* In this method, a cut is placed onto the stock on the upper-right corner, and then slid down until it meets a horizontal edge. Then this method slides the cut into the left until it meets a vertical edge. (Lesh, et al., 2005)(Baker, et al., 1980)

*Next-fit decreasing:* Sorts each cut in decreasing order, and the largest one is placed according to next fit.<sup>1</sup>

*First-fit decreasing:* This heuristic sorts the required cuts according to descending order on the longest dimensions of each cut and assigns them to the first available stock. Here first fit refers to the cuts being placed from left to right. The algorithm starts with first (leftmost) available space on the stock to see if it fits there. If not, it checks the next available space to the right. If no spaces are found, a new stock is generated.<sup>1</sup>

*Best-fit decreasing:* Item *j* is packed left justified on that open space/stock, among those where it fits, for which the unused horizontal open space is a minimum. If no shelf can accommodate *j*, a new stock is initialized as in NFDH.<sup>1</sup>

While the above heuristics approach near optimal resolutions, the below algorithmic solutions can give near perfect solutions:

*Sequential Value Correction:* This approach as described by Mukhacheva and Mukhacheva, always selects the left-most free space in the last free space, and fills it with a one dimensional greedy heuristic. This approach only considers the width of the rectangles and fills every free space by ordering the heights in non-increasing manner.

*Generic Algorithm:* At every iteration of this algorithm, a fitness value is calculated for each of the nodes representation the potential solutions. Based on the fitness function, a number of potential parental nodes are selected from which other individuals can parent (Patrick, et al., 2000).

*Continuous Relaxation:* This algorithmic paradigm typically models the problem as an integer program, solves a linear programming relaxation, and then uses the optimal fractional solution to construct a feasible solution for the original problem by rounding. Then the value of the rounded solution output by the algorithm is analyzed by comparing it to the value of the fractional solution.

*Branch and Bound:* Recursively solves sub-problems in which some of the fractional variables have their values fixed to either zero or one. In each step it considers a sub-problem of the original 0-1 integer programming which some of the variables have values assigned to them, either 0 or 1, and the remaining variables are still free to take on either value.

**Heuristic Analysis**

Given all of the above methodologies, how do we ascertain which to follow? As we mentioned earlier, our goal for this paper wasn't only to find an acceptable approximation, but also to deliver this concept in a timely manner. Therefore, we analyzed each solution by theoretically measuring it for the following attributes:

*Complexity:* how conceptually, algorithmically, structurally, and cognitively complex the solution is—the higher the complexity of the solution, the greater the risk for error and time needed for testing.

*Accuracy:* the degree with which the methodology approximates the optimal solution – the greater the accuracy, the more acceptable.

*Modifiability:* how well the proposed solution can be reused, modified, or redirected to other industry problem sets – the greater the modularity of the solution the longer and more effectively utilized, and the higher the yield for the stakeholder's investment.

Based on the above criterion, we rated each methodology as follows:

Methodology	Complexity	Accuracy	Modifiability
First Fit (FF)	++	-	+
Best Fit (BF)	++	-	+
Worst Fit (WF)	++	--	+
Next Fit (NF)	++	--	+
Almost Worst Fit (AWF)	++	-	+

<sup>1</sup> (Terashima-Marin, et al., 2006)



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Bottom-Left Heuristic	++	--	++
Next-fit decreasing	+	-	++
First-fit decreasing	+	+	+
Best-fit decreasing	+	+	+
Sequential Value Correction	+	+	-
Generic Algorithm	-	+	-
Continuous Relaxation	--	++	--
Branch and Bound	--	++	-

While relaxation and branch-and-bound problems can approximate the best fit, they tended to be problematic for development or testing due to the necessity for integration or purchase of LP solvers. Generic algorithms and SVC also provided higher than acceptable complexity given our production timeline.

While the most optimized solutions were constrained by understandability, the lament heuristics were not able to address the problem with an acceptable accuracy. As a result, we pursued the first and best-fit algorithms for the purpose of this paper.

In the next section we will describe these heuristics in more details.

### Heuristic Description

As we saw in the prior section, accuracy and complexity are directly related when reviewing the classic proposed solution to the packing/cutting problems. Complex solutions provide better accuracy, but they increase development time and cost. Therefore we set out to pursue a solution that revolved around an approximate heuristic with acceptable accuracy. In this section we will explore the BL, Fit-First, and Best-Fit heuristics in order to better understand the problem at hand.

While each heuristic approaches the problem differently, they typically share the same methods for sorting the queued rectangles. Most of the heuristics assume that the space or strip is ordered in some manner. Later we will discuss how this can be an important factor in realizing a more optimized and real-time solution.

Therefore, given a set of cuts, we will trivialize this important step by first ordering each cut based on the largest side – if the  $W = 10$  &  $H = 8$ , the item would be ordered *Width* first. This way, all available rectangles are ordered by their longest orientation.



Figure 1 - Raw stock



Figure 2

Now let's examine how the heuristic would aid in discovering approximate solution to the problem. Above figure (Figure 1) describes the raw stock (or available space) that we will be using to orient nested cuts onto.

As an experiment, let's follow the BL. BL approaches the problem by positioning each new rectangular cut/strip at the bottom left of the stock (figure 2).

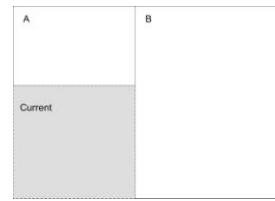


Figure 3. Current space utilization

Now the question becomes, how do we choose where to position our next selection? It is here that heuristics and algorithms detach from each other.

Our first challenge becomes the description of the available stock (or free space). For experimental purposes, let's simply define the available space by partitioning the space into two segments – A and B (later in the paper we will describe how to orient and choose the available space segmentation).

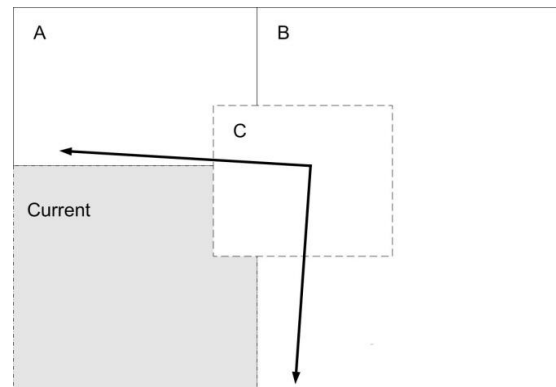


Figure 4. Which space do we choose?

If the next item in the list is piece C, how do we ascertain which space to fit this selection? (Figure 4)

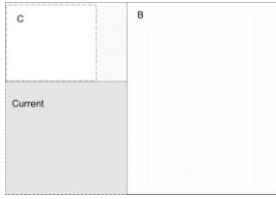


Figure 5. Best Fit -- Which rectangle results in the least waste?

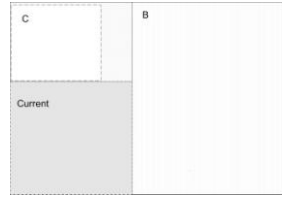


Figure 6. Fit-First -- Depending on the orthogonal position of the rectangle, place in the first open space

If we choose to implement the *Best-Fit* methodology, we would attempt each available space, and choose the rectangle that generates the least amount of waste. Calculating the waste produced can be defined by the numerous methods such as perimeter and area.

If we opt for the *Fit-First*, we would simply drop fit the rectangle in either space, given an adopted methodology for orientation.

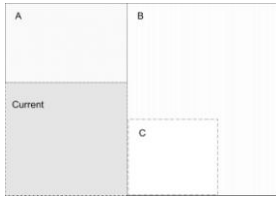


Figure 7. Bottom Left -- Chooses the empty rectangle which is more to the bottom left

Finally, if we were to simply follow the *Bottom-Left* heuristic, we would fit the cut in the further most bottom-left rectangle.

**Variable Consideration**

Now that we have a better understanding of the underlying problem, let's explain how to approach the solution. To do so, let us describe and annotate by following the subsequent succeeding diagrams.

We should now realize that how we define the remaining waste is the key in its reduction. We can segment the remaining spaces into two new stock (or space segments) by making a guillotine cut either horizontally or vertically. Figure 8 and 9 draw-out how this decision can affect our available stock area.

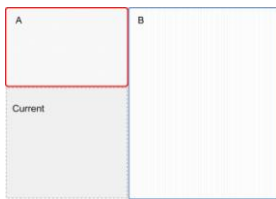


Figure 8. Apportion horizontally

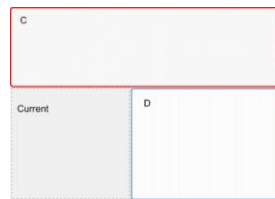


Figure 9. Apportion vertically

As the diagrams depict, how we select the new spaces can substantially affect what can be re-fitted. In figure 8, we have two proportional divisions, while in figure 9 we

have “oddly” shaped rectangles. Yet, it is uncertain as to the effect of the decision, until all remaining rectangles are considered. If our remaining cuts are a series of thin bands, then the second approach would be more advantages.

This is an important distinction between complex solutions and simple heuristics. While a solution like LP relaxation can finalize an approximate solution given the best fit across all cuts, a heuristic can hope to order the list of cuts in such a manner that they fall in line correctly. By simply re-ordering or randomizing the set of items, you can reduce or increase the accuracy and performance of the heuristic.

It is for this reason that the purposed approach has to be carefully analyzed in order to identify areas to optimize. In the next section we decompose the heuristic further, and graphically depict the steps to clarify the approach we will use to implant a heuristically applied solution.

**Proposed Approach**

Given that most programming languages consider the origin of the screen at top left, we decided to approach the problem by placing the first item there and apportion the remaining space based on how large of a surface area the remaining two spaces provided to the bottom left – our implementation therefore, will be called Top-Left.



Figure 10

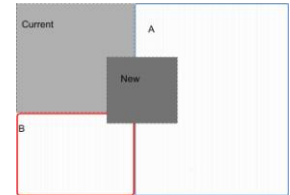


Figure 11

We will follow a vertical guillotine cut (figure 10) to apportion the remaining spaces.

We now want to place the new opening (figure 11) in such a manner as to reduce the amount wasted space.

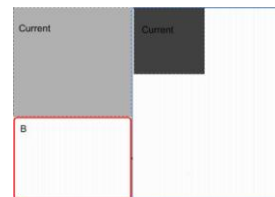


Figure 12



Figure 13

If we place the new rectangle into opening A, our proportion of waste to remaining surface area would be higher than if we placed the new opening into B. Therefore we will place the new cut (C) onto opening B.

Now we can re-apportion the stock into new remaining rectangles by directing a vertical guillotine cut.

## Variably Nested Rectangle Strip Cutting Optimization

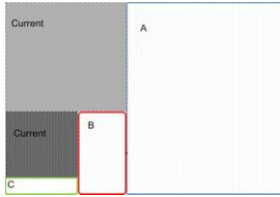


Figure 14

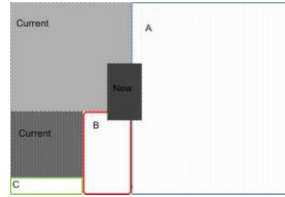


Figure 15

In essence, we now have three stock openings (A, B, C), with three different dimensional values. These openings plus the “fitted” stock represent one unit of raw stock/stock.

Now if we introduce another opening (figure 15), we can approach the problem by following back through the heuristic.



Figure 16



Figure 17

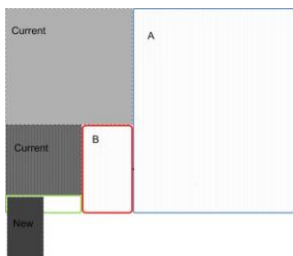


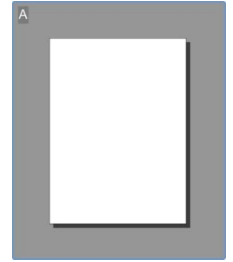
Figure 18

As figure 16, 17, and 18 shows, a new opening would follow the same heuristic as before. Fit into the first opening, gather the fitness (amount of waste created as a result), and compare by iterating through the remaining openings.

### Observations

While reviewing this approach it becomes clear that the problem can be decomposed and simplified. If we divide opening/space into two priority queues, one with openings (available space) and the other with rectangles (cuts), then our heuristic would simply have to match cuts (based on the longest orientation, if it doesn't fit, rotate, and re-try) to openings. That is, rather than attempting each opening available, gathering fitness, and comparing, the placement of the cut in the hierarchy of the queue would define which opening it would best fit in. What makes this significant is that if your interior cut did not utilize the full stock, in a modifiable heuristic, it can still operate by resolving to an approximate value.

Now, let's suppose there is single rectangular cut, the cut itself has another cut nested within it. The final product is not the rectangular shape, but rather a routed edge of the original plus another rectangle. The figure to the right shows this very common usage of stock. If we were thinking in terms of space, suppose that a box contains a hollowed object, which we can fit another object into. If we wanted to maximize our utilization, we would also utilize that wasted space by placing a smaller object within it.



If we follow the above heuristics (BF, FF, or BL) we might not be able to utilize the interior cut during the ordering of the cut plan. That is, our heuristic does not enable the production planning to account of the nesting of material. We would have to create a whole other production plan upon the completion of the current one to account for these wasted spaces. This would reduce the modifiability of the approach and therefore decrease its reusability in other markets such as metal stamping or framing. In these markets this concept of nested rectangles becomes a great motivator for reducing waste. It is not only important to reduce the “outside” cut (the outline of the rectangular shape), and to reduce and reuse the inside cuts (the interior “stamp” that is left).

Therefore, it is clear that our approach need to address cut-optimization is such a manner that the reduction in waste not only addresses surface area of the outside rectangle, but also the waste nested within its interior bounds.

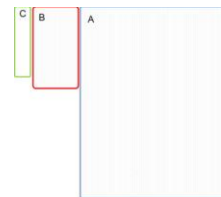


Figure 19

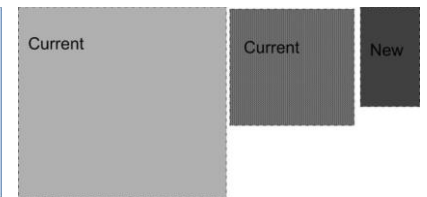


Figure 20

At first it may appear that we have substantially increased our complexity and capacity for finding a heuristically driven approach. Yet this problem can be significantly reduced to address both problems.

How? As we stated earlier, we can classify two types of objects and follow the same decision algorithm for each one. I.e. one object would represent the opening (figure 19), sorted either ascending or descending in height or width. The other object would represent the cuts, sorted either ascending or descending. (Figure 20)

By following this iteration, we can “fit” cuts into openings, regardless of calculating or recalculating the true remaining overall stock. When a new cut is placed onto an opening, two remaining openings are produced. Each opening represents an apportioned rectangular

waste that can be re-entered into the queue to be used upon the next iteration.

This also enables production to fit new incoming cuts into available openings without reconfiguring the entire cut plan, creating a more agile and adaptable solution in a production environment. In a live environment there are often personnel errors, order priority, quality assurance re-possession, etc... that require a list to be dynamically re-organized.

Below, we describe this approach using a flow for decisions:

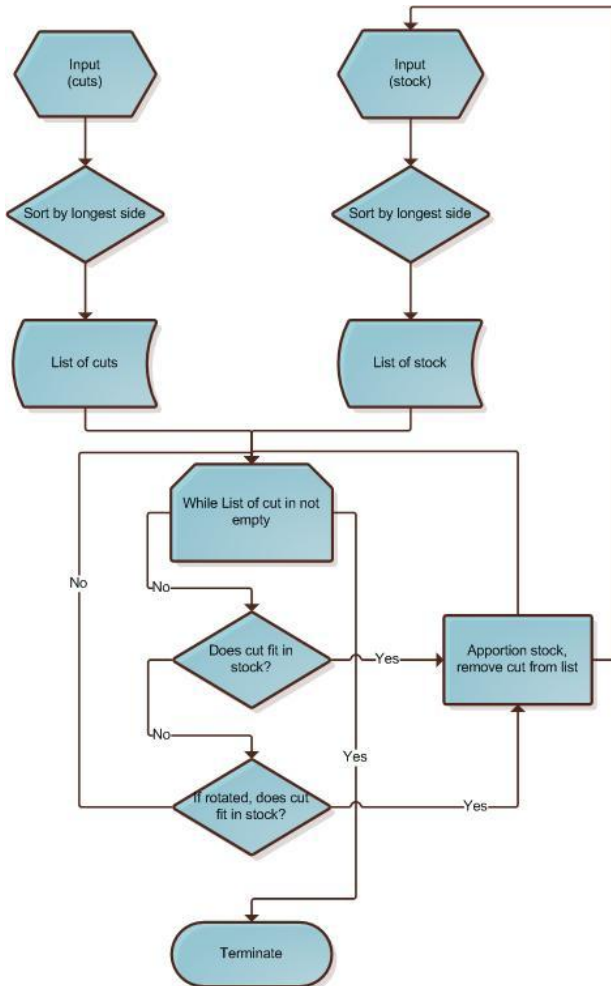


Figure 21 - Process Flow

## Implementation/Finding

In our implementation, we used C# programming language within Visual Studio 10 framework. Our final product was able to visually display the cut-plan so that it could be inspected by the practitioner. To measure success, we compared the proposed approach to the Next-fit decreasing algorithm. To test the approaches we ran both algorithms 100 times apiece with 50 cut samples. The cut samples were chosen at random out of

a set of 130 distinct cuts. The outside cuts ranged from 4 by 4 inches to 16 by 20 inches, the inside cuts ranged from 3 by 3 inches to 14 by 18 inches and every stock was 40 inches. The goal of each test was minimize the number of stocks used to fit the 50 cut samples.

Out of 100 trials the proposed approach outperformed the Next-fit decreasing algorithm 98 out of 100 times. The proposed approach performed better by using 1 less stock 33% of the time, 2 less stocks 48% of the time, and by 3 or more stocks 17% of the time. At worst the proposed approach used the same number of stocks 2% of the time.

## Conclusion

In this paper we examined many different approaches to the classic Bin packing/Strip cutting problem. We explained how each methodology identifies and approaches a solution. Although some methods provided better opportunity for optimizing the final space/waste with accuracy, they proved to be too complex and rigid to pursue development. Therefore, this paper proposed a heuristically driven solution that adapts the Next-fit algorithm with an extension to address rectangle nesting.

While comparing the proposed approach (Top-Left) to the Next-fit decreasing algorithm, we observed that the proposed approach will outperform Next-fit decreasing 98% of the time. Also, the proposed solution is able to approximate the cut/placement plan within seconds, with little performance digression, and stayed within the acceptable accuracy bounds.

More importantly, our heuristically applied solution was able to approximate a solution, from design to development and testing, within a two-month time frame. Furthermore, by expanding the heuristic to handle nested opening, the nesting of interior and exterior rectangles was decomposed and handled using the same agile adaptation of the Top-Left heuristic providing greater adaptability across many industries.

## Future Work

In order to better analyze and measure the affects of other algorithmic and heuristically applied approaches to complexity, accuracy, and modifiability, we will be pursuing the research, development, and testing of the numerous methodologies in order to provide numerical comparison data.

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## **The Growth of E-Commerce and the Relationship to Supply Chain Integration**

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### **ABSTRACT**

The use of Electronic Commerce (e-Commerce) has grown steadily and has gained a firm footing as a widely accepted business practice today. 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 \$3,333 Billion in 2007. In fact, e-Commerce grew at twice the rate of the Shipments, Sales and Revenues themselves (i.e. a 313.8% increase in e-Commerce versus a 149.1% increase in Shipments, Sales and Revenues). The category of Business-to-Business (B-to-B) e-Commerce applications was the main contributor to this growth with Manufacturing B-to-B accounting for more than 92% of the E-commerce total in each of the eight years. The Business-to-Consumer (B-to-C) e-Commerce applications which are characteristic of retail and online marketers accounted for a much smaller portion reaching \$251 Billion in 2007 which translates to 7.5% of the total e-Commerce Shipments, Sales and Revenues in the U.S. The growing use of e-Commerce in the Manufacturing sector and the dominance of B-to-B over B-to-C as the main contributor, paint a favorable picture for many different factors related to supply chain integration. This paper will summarize the e-Commerce annual statistics available from the U.S. Census Bureau and discuss the direct connection between the growth of e-Commerce and continuing efforts to achieve better supply chain integration by many companies.

### **Introduction**

Electronic Commerce (e-Commerce) became a popular conceptual research topic in the late 1990's and began to show up in practice with increasing frequency as we entered the 2000's. E-Commerce is commonly divided into two categories: business-to-business (B-to-B) or business-to-consumer (B-to-C). B-to-B is characteristically related to manufacturing and wholesale industries while B-to-C is typically associated with retail industries and other service industries.

In the remainder of this section we will describe and define the main concepts of e-Commerce and supply chain integration. We will also briefly describe the information technologies which are needed to make e-commerce and supply chain integration possible.

### **e-Commerce and e-Business**

A very basic definition of e-Commerce is "conducting business transactions with suppliers and customers electronically" [6]. Another simple definition states that "e-commerce is defined as the use of the Internet to facilitate, execute, and process business transactions" [5]. 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" [7].

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” [8]. 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 B-to-B transactions which we focus on in this paper.

### **Supply Chain Integration**

To remain competitive and to improve supply chain performance, companies formulate and implement a variety of supply chain strategies. Supply chain integration is a broad range of supply chain strategies which focus on improving “coordination and collaboration among supply chain partners” [8].

“Information technology, and in particular, the Internet, play a key role in furthering the goals of supply chain integration. While the most visible manifestation of the Internet has been in the emergence of electronic commerce as a new retail channel, it is likely that the Internet will have an even more profound impact on business-to-business interaction, especially in the area of supply chain integration” [8, p. 2].

More to the point, Swafford et al. describe IT (information technology) integration as “an enabling mechanism that positively impacts supply chain flexibility and supply chain agility” [13]. Swafford et al. summarize their findings as a “domino effect” where IT integration “enables a firm to tap its supply chain flexibility which in turn results in higher supply chain agility and ultimately higher competitive business performance” [13]. From this perspective, IT integration has a direct impact on responsiveness to customers which corresponds with a main objective of e-Commerce.

The following two statements highlight the limited progress with B-to-B (or B2B) e-Commerce in the 2000 to 2001 timeframe. “In early 2000, relatively few companies had implemented B2B electronic commerce platforms, but the rate of technology change in this area has now escalated rapidly” [9]. “In fact, e-business has already had a significant impact on supply chain integration, but it is safe to say that we have only scratched the surface” [8]. Given these statements and projections from 2000-2001, it should be interesting to see exactly how much progress has been made in the subsequent years.

### **Information Technology**

As the above discussion has already hinted, information technology is an essential element to achieve supply chain integration. Also as mentioned above, the Internet is the central technology element which makes e-Commerce possible. Internet usage is necessary but it is not sufficient to conduct e-Commerce. The deployment of other specialized technologies is another critical element. Individual companies must have the appropriate technology applications and suitable technology compatibilities with their supply chain partners in order to utilize the Internet to the fullest extent. The main technologies that enable e-Commerce “are the Internet, an extranet, or an EDI system” [6].

Information Technology components for successful supply chain management range from simple information sharing applications such as e-mail, EDI, and document sharing such as Google Docs, to decision making and decision enhancing applications such as artificial intelligence/expert systems, virtual “dashboards” and/or information portals, and data warehousing/mining. “At the application level, typical technologies would include: telephone, fax, EDI, electronic mail, electronic funds transfer, and the Internet” [7]. These IT components

must be aligned with the policies, procedures, and goals of the organization and/or industry at hand in order to be successful across the entire supply chain [12]. According to AMR Research, the domain of supply chain planning is populated by applications from such companies as Oracle, AspenTech, i2 Technologies, John Galt, Logility, and SAP [1].

### **E-Commerce and Supply Chain Integration Success**

DeLone and McLean have proposed a success model for information systems [2] [3] [4] and have updated and extended the discussion of this model to incorporate e-commerce success [5]. More than 300 research articles have cited the DeLone and McLean Information Systems success model since its introduction in 1992 [5]. Many of those researchers have also utilized the model in their empirical research [5]. The model is composed of six success dimensions:

1. System quality
2. Information quality
3. Service quality
4. Usage
5. User satisfaction
6. Net benefits [5].

In reviewing a broad sample of prior research, DeLone and McLean concluded that any of the success metrics used by others could easily fit into one of the six success dimensions [5].

While these research efforts have addressed consumer-focused e-Commerce or B-to-C, we feel that these dimensions can be readily applied to B-to-B situations. For the purposes of this paper we will focus on one dimension in particular, “Usage”. This is consistent with a recommendation from DeLone and McLean: “despite the multidimensional and contingent nature of e-commerce success, an attempt should be made to significantly reduce the number of different measures used to measure success, so that research results can be compared and findings validated” [5]. We also suggest that each of the six dimensions must show favorable results for companies to continue to deploy B-to-B applications and for other companies to decide to implement B-to-B technologies. This is true since there are many interrelationships among the six success dimensions. Focusing on a single dimension simplifies the collection and use of data and will assist future research seeking to make comparisons as DeLone and McLean suggest [5].

### **E-Commerce Statistics**

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” [14]. 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) [14]. The ASM is a survey which collects a wide range of data from more than 50,000 manufacturing plants in the United States [14].

These statistics are stated in dollar values for shipments which serves as a measure of “usage” for B-to-B 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.

According to the “E-Stats” 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 \$3,333 Billion in 2007. In fact, E-commerce grew at twice the rate of the Shipments, Sales and Revenues themselves (i.e. a 313.8% increase in E-commerce versus a



149.1% increase in Shipments, Sales and Revenues). The category of Business-to-Business (B-to-B) e-commerce applications was the main contributor to this growth with Manufacturing and Merchant Wholesale B-to-B accounting for more than 92% of the E-commerce total in each of the eight years [14].

It is also important to understand the definitions of e-Commerce which are being used in conjunction with these statistics. One note which accompanies “E-Stats” includes the following statement: “manufacturing and wholesale e-commerce is entirely B-to-B, and retail and service e-commerce is entirely B-to-C” [14]. These are also acknowledged as “simplifying assumptions” [14]. For the purposes of this paper, we extracted the pertinent data from “E-Stats” which relates to the manufacturing and wholesale business arenas. These are the central economic sectors which account for all of the business-to-business (B-to-B) e-commerce transactions according to the definition of B-to-B mentioned above which is being used by the U.S. Census Bureau.

The following Tables summarize the five most recent years of E-commerce focusing on the business-to-business (B-to-B) associated with the manufacturing and wholesale sectors. Five years were used rather than eight years to maintain consistency in the detailed descriptions shown in Tables 5 and 6. The details presented there were not provided in the first few years of the E-Stats.

Table 1. Total Shipments<sup>†</sup> (Values are in Billions of Dollars)

	2007	2006*	2005*	2004*	2003*
Total Shipments	21,847	20,797	19,583	18,123	16,740
B-to-B	11,088	10,542	10,605	9,109	8,360
- Manufacturing	5,306	5,016	4,742	4,309	4,015
- Merchant Wholesale	5,782	5,526	5,181	4,800	4,345

Source: [14].

\* Each year’s data is revised in the following year’s report; revised numbers are used when available.

<sup>†</sup> Totals in this table include E-commerce and amounts handled by other methods.

Table 2. e-Commerce Shipments (Values are in Billions of Dollars)

	2007	2006*	2005*	2004*	2003*
Total Shipments	3,333	2,972	2,579	2,051	1,706
B-to-B	3,082	2,761	2,393	1,892	1,599
- Manufacturing	1,856	1,567	1,344	996	843
- Merchant Wholesale	1,226	1,194	1,049	896	756

Source: [14].

\* Each year’s data is revised in the following year’s report; revised numbers are used when available.

During this five year period the Manufacturing B-to-B increased by 220% while the Merchant Wholesale B-to-B increased by 162% when comparing 2007 to 2003 e-Commerce shipments. Note that summing the two numbers for Manufacturing and Merchant Wholesale equates to the total listed for B-to-B. The difference between Total Shipments and B-to-B equates to the amount of e-commerce attributed to B-to-C (which is not shown in this table).

Table 3 lists the e-Commerce shipments as a percent of the Total Shipments for the five year period from 2003 to 2007.

Table 3. e-Commerce (% of Total Shipments)

	2007	2006*	2005*	2004*	2003*
Total Shipments	15.3%	14.3%	13.2%	11.3%	10.2%
B-to-B	27.8%	26.2%	22.6%	20.8%	19.1%
- Manufacturing	35.0%	31.2%	28.3%	23.1%	21.0%
- Merchant Wholesale	21.2%	21.6%	20.2%	18.7%	17.4%

Source: [14]

Table 4 lists the year-over-year increases of e-commerce shipments for the most recent five years available to compare. Notice that the largest year-over-year increase occurred from 2004 to 2005 for the Manufacturing sector at 34.9%. In all four comparisons, Manufacturing e-commerce shipments increased by 16.6% to 18.4%. Merchant Wholesale maintained double digit increases with the exception of 2007 which resulted in a small increase of 2.7% when compared to 2006.

Table 4. Year-over-Year e-Commerce Increases

	07 v. 06	06 v. 05	05 v. 04	04 v. 03
Total Shipments	12.1%	15.2%	25.7%	20.2%
B-to-B	11.6%	15.4%	26.5%	18.3%
- Manufacturing	18.4%	16.6%	34.9%	18.1%
- Merchant Wholesale	2.7%	13.8%	17.1%	18.5%

Source: [14]

### The NAICS Industry Groups

The North American Industry Classification System (NAICS) was developed and adopted in 1997 to take the place of the previous Standard Industrial Classification (SIC) system [10]. The NAICS groups and numbering system are now used by all of the U.S. Federal statistical agencies including the the Office of Management and Budget, the Bureau of Economic Analysis, the Bureau of Labor Statistics and the U.S. Census Bureau [11]. The NAICS groups allow us to explore specific industry groups from within the broader Manufacturing sector where e-commerce has become more dominant than other industry groups.

### Leading Industry Groups

Beverage and Tobacco Products (NAICS 312) was 1<sup>st</sup> in 2007 with 56.5% of their shipments utilizing E-commerce. Transportation Equipment (NAICS 336) was 2<sup>nd</sup> in 2007 with 55.6% of their shipments executed via E-commerce. The two groups exchanged positions compared to 2006. Transportation Equipment was at 54.9% “e-shipsments” in 2006 while Beverage and Tobacco Products had 54.7% “e-shipsments” [14]. Five or six sectors accounted for roughly 70% of E-commerce shipments in each of the five most recent years. These sectors are listed for each year in Table 5:

Table 5. Sectors Accounting for the Majority of B-to-B

Year	Sectors Contributing 70% of B-to-B
2007	Transportation Equipment, Chemical Products, Food Products, Petroleum and Coal Products, Computer and Electronic Products, and Machinery Products
2006	Transportation Equipment, Chemical Products, Petroleum and Coal Products, Food Products, Computer and Electronic Products, and Machinery Products
2005	Transportation Equipment, Chemical Products, Petroleum and Coal Products, Food Products, Computer and Electronic Products, and Machinery Products
2004	Transportation Equipment, Chemical Products, Petroleum and Coal Products, Computer and Electronic Products, Food Products, and Beverage and Tobacco Products
2003	Transportation Equipment, Chemical Products, Computer and Electronic Products, Food Products, and Petroleum and Coal Products

Source: [14]

From Table 5, we can see that the same five or six industry sectors contribute the majority of the total value of e-Commerce shipments over the five most recent years. This is an indication that these industries are maintaining their commitment to their e-Commerce initiatives.

### Industry Groups with Highest E-Commerce Growth

Substantial growth in the use of E-commerce was evident in several industry groups in each of the years. The Industry Groups with the largest B-to-B growth in each year are listed in Table 6.

Table 6. Highest B-to-B Growth

Year	Industry Groups with Highest B-to-B Growth
2007	Paper Products e-commerce grew by 50%, Leather and Allied Products grew by 46%, Primary Metal Products grew by 34%, Printing and Related Support Activities grew by 34% and Food Products grew by 32%.
2006	Textiles Mills e-commerce grew by 65%, Textile Product Mills grew by 61%, and Food Products grew by 56%.
2005	Printing and Related Products e-commerce grew by 90%, Petroleum and Coal Products grew by 55%, Chemicals grew by 54%, Paper Products grew by 52%, Textile Mills grew by 52%, Wood Products grew by 52%, and Food Products grew by 48%
2004	Primary Metals e-commerce grew by 166%, Printing grew by 86%, Petroleum and Coal Products grew by 50%, Machinery grew by 50%, Fabricated Metal Products grew by 43%, and Wood Products grew by 39%
2003	Overall E-Shipments grew by 12.1%; Petroleum and Coal was a main contributor to that increase with a 102% e-commerce increase compared to the prior year

Source: [14]

Table 6 contains the Industry Groups which are committing more money and more effort to B-to-B initiatives and technologies in order to enhance their competitive position. The growth shown in Table 6 ultimately leads to a greater contribution to overall B-to-B usage which was indicated in Table 5. Petroleum and Coal Products and Chemical Products are examples of Industry Groups with significant growth in earlier years (2003, 2004 and 2005) leading to a greater B-to-B share in later years (2006 and 2007).

### Industry Group

As we drill down in a sector to a more specific industry group we explore the components of the Transportation Equipment sector. Transportation Equipment (NAICS 336) is one sector where e-Commerce has grown to become a majority (in the 54 to 56% range) of all of the shipments for the last few years [14]. This sector is impacted significantly by the Motor Vehicle Manufacturing category (NAICS 3361) which also includes sub-classifications for all the automotive supplier categories. This classification (NAICS 336) also includes aircraft (NAICS 3364 Aerospace Product and Parts Manufacturing) and other transportation equipment categories as well [10].

We might view Transportation Equipment as a benchmark at one level but we need to look at Motor Vehicle Manufacturing as a more focused industry group to serve as a benchmark at that level. This sector and industry group has shown clear leadership with their B-to-B performance throughout the five year period.

### Conclusions and Future Research

As Lee and Whang suggested, the “adoption of the Internet to accelerate the goal of supply chain integration” [8] was expected to continue. Several authors indicated in 2000 and 2001 that little progress had been made with e-business or B-to-B transactions. Significant growth was expected in the future. The statistics presented here are an indication of the rate of diffusion or growth of supply chain integration and substantiate the predictions.

E-Commerce continues to grow but represents less than a majority of shipments in most industries. In many industries there is still a huge percentage of shipments that are not handled via e-Commerce. That percentage represents an opportunity for further growth of e-Commerce.

One curious finding reported in the E-Stats discussion is the fact that companies are still “overwhelmingly” relying upon proprietary systems such as EDI [14]. This is an indication that the Internet is not being utilized fully by these companies if they are exchanging electronic data utilizing leased private data lines. This represents a data security issue and it may also partially explain why the B-to-B numbers are not higher. To be successful with supply chain integration, the best available technologies should be utilized. This finding certainly raises questions about the technology in use.

We feel that the E-Stats data serves as a good proxy measure of supply chain integration. The data also serves as a very good measure of “usage” which can be used in conjunction with the DeLone and McLean success model at the appropriate level of analysis.

Future research will focus on the leading industries to better understand how they have achieved their level of success with e-Commerce. Future research will look at supply chain integration and supply chain performance for those leading industries. The DeLone and McLean success model will also be explored further in future research utilizing the E-Stats data.

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# **CLIENT SATISFACTION SURVEYS: A PROCESS IMPROVEMENT TOOL FOR LAW FIRMS**

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## **ABSTRACT**

Total Quality Management initiatives took root in the manufacturing sector in the 1980s. As corporations sought legal counsel from outside firms, expectations grew among corporate clients for law firms to engage in the same continuous improvement cycle that they found success applying. This paper examines the best practices for process improvement in law firms. It considers the existing recommendations from the law firm's administrative and marketing perspective, and it profiles how one southeastern firm with 180 lawyers is engaging in process improvement.

## **INTRODUCTION**

Dr. W. Edwards Deming, Dr. Joseph Juran, and others were the forefathers of process improvement techniques. Deming's fourteen points and his advice to improve the system rather than blaming the workers served to transform manufacturing quality all over the world. Juran's trilogy of quality included planning, control, and improvement. As manufacturing organizations focused on continuous improvement using the Plan/Do/Check/Act system, they were able to improve quality.

Total Quality Management (TQM) programs focused on delighting the customer, continuous improvement, employee involvement, concern for quality at all levels of the organization, ongoing education, and statistical process control. With the exception of the last point, most service providers could easily embrace the values of TQM, but there were few programs in place and little understanding about measuring abstract concepts such as customer service, timeliness, courtesy, and effective service delivery.

## **EXPANSION OF TQM TO THE SERVICE SECTOR**

Defining and measuring quality in services requires reflection on the key differences between goods and services. Customers perceive courtesy and timeliness to be critical measures of quality. Unlike goods, the service provider is inextricably connected to the delivery of the service itself, and the customer associates the two as one. Service delivery is

more personal, and customers notice attitudes, nonverbal signals, and communication style. Often, the service deliverer is unaware of these perceptions.

When given a chance to voice their complaints, customers will often share concerns that service providers need to know. The majority of customers will give an organization a second chance when they believe sellers have genuinely taken steps to improve their product or service delivery.

One definition of customer satisfaction states:

Customer satisfaction is the state of mind that customers have about a company when their expectations have been met or exceeded over the lifetime of the product or service. The achievement of customer satisfaction leads to company loyalty and product repurchase. [13]

Although results will vary depending on the nature of the industry, available statistics show that improving customer satisfaction is a direct route to improving profits, both short term and long term. Here are some estimates from *Quality Digest*:

- A 5% increase in loyalty can increase profits by 25%-85%.
- A very satisfied customer is nearly six times more likely to be loyal and to repurchase and/or recommend your product than is a customer who is just satisfied.
- Only 4% of dissatisfied customers will complain.
- The average customer with a problem eventually tells nine other people.
- Satisfied customers tell five other people about their good treatment. [13]

Former Secretary of Commerce Malcolm Baldrige brought the need for US firms to focus on improving quality to the attention of Congress in the 1980s. After his accidental death in a rodeo accident, Congress named the US Quality award for him in 1989. The Malcolm Baldrige National Quality Award was to be given to firms who showed the best work in improving quality. In its original form, The Baldrige Award invited entries in three categories: manufacturing, services, and small business.

By the late 1990s, the term "Quality Management" had evolved to become "Process Improvement" and had expanded to the services sector. Although many manufacturing engineers had a hard time imagining how health care, education, law firms, and other prominent professional services could apply these techniques, leaders in this field broke through the wall. In 2001, the Baldrige award opened the Education category, and in 2002, it gave its first award in Health Care. In 2007, it expanded to add a Non-Profit category. To date, no law firm has won the Baldrige Award. [10]

## **TERMINOLOGY IN PROFESSIONAL SERVICES**

Process improvement language involving non-manufacturing organizations varies widely. Professional services including health care providers, accountants, lawyers, engineers,

consultants, and educators have developed their own nomenclature to describe quality improvement in their fields. The term “quality” is common in health care, while educators refer to “learning outcomes.”

The legal, engineering, and accounting fields have adopted the term “Client Satisfaction” to describe quality enhancement techniques. Much of the revenue generated in these firms is based on relationships with repeat clients. These clients may not tell the professionals about service disappointments unless they are asked. Client Satisfaction Surveys are the primary tool used by these firms to understand and improve.

### **EARLY ADOPTION OF TQM IN LAW FIRMS**

In the early 1990s, the literature began to promote the expansion of total quality management techniques to law firms. Many of these early advocates were not exactly sure how to make the leap (Road Map for Quality), but they saw the successes applied in other services and wanted to begin the discussion. In 1992, the American Bar Association appointed a TQM Task Force to explore specific ways to apply TQM to the legal profession. [1]

In 1996, *Quality Progress* reported about a law firm which started the TQM process by requiring lawyers to read Stephen Covey’s *The 7 Habits of Highly Effective People* and *Principle Centered Leadership*. They used the habit “Begin with the End in Mind,” and required the attorneys to develop a mission statement for the firm. In their ensuing discussion, they redrafted the statement many times and haggled over subtle word choices, but they were proud of their final result. It was what they now consider their first step on the quality journey. [1]

Another firm in this report redrafted Deming’s Fourteen Points to apply specifically to law firms. Table 1 shows how they related the points.

### **CLIENT SATISFACTION SURVEYS**

After the early efforts to apply TQM, professional services began to focus on the client in the form of Client Satisfaction Surveys.

The business of practicing law in the private sector revolves around the challenge of creating and growing client relationships. In an increasingly competitive marketplace, law firms are looking for ways to turn one-time or periodic users of legal services into institutional clients. Firm’s which are successful in developing institutional clients are client focused and recognize the importance of developing programs to measure the expectations of clients and the firm’s ability to meet or exceed those expectations.

There are several methods of gathering client feedback but the most widely used and most cost effective tool is the Client Satisfaction Survey. The successfully conducted survey can glean information to help a law firm:



- Establish clear and more productive relationships between the law firm and the client
- Identify areas for potential growth of firm's practice
- Evaluate present level of client satisfaction and identify potential cross marketing opportunities
- Address problem areas with clients
- Prepare strategic and/or marketing plans based on client growth and needs
- Demonstrate the firm's commitment to the delivery of quality legal services to the client. [9]

<b>Deming's Points</b>	<b>Law Firm Application</b>
1. Create a constancy of purpose	Dedicate quality for the long term
2. Adopt the new philosophy	Recognize the need for better management
3. Cease mass inspection	Require quality inputs (people, equipment) and improve processes (legal research, filing, billing).
4. Don't buy from the cheapest supplier. Buy from the high quality supplier.	Apply this principle to computer systems, office supplies, and so on.
5. Improve constantly	Improve every process (methods, skills; keep records (measure); reduce variation (time sheets, faxes, turnover)
6. Institute training on the job	Learn the firm, reduce job training by coworkers; improve training resources such as training materials and facilities
7. Adopt and institute leadership	Help people do a better job by coaching, mentoring; restore pride in your work
8. Drive out fear	Don't manage by fear; make people feel secure; motivate
9. Break down barriers between staff areas	Create teamwork among partners and associates, attorneys and secretaries, legal staff and support staff, branch offices and home office
10. Eliminate slogans	Provide the means to do the job (technology, training); walk the talk
11. Eliminate numerical quotas	De-emphasize billable hours; expand alternate billing arrangements; reward client service
12. Remove barriers that rob people of pride of workmanship	Recognize that people want to do a good job; improve communication to everyone
13. Institute a vigorous program of education and self-improvement for everyone	Read and discuss Deming, Juran, and Covey; emphasize education and retraining; conduct seminars and training on teamwork, problem solving, statistical techniques, and so on.
14. Put everybody in the company to work to accomplish the transformation	Have a plan, a vision; management must drive it

**TABLE 1. The Law Firm's Application of Deming's Fourteen Points [1]**

## Questions to Ask in a Client Satisfaction Survey

Law firms using client satisfaction surveys ask questions in a range of areas ripe for improvement. Typical questions are:

- What was your first impression of the firm? Of your attorney?
- How were you initially treated during your first in-person meeting?
- What do you believe is our biggest strength?
- What do you believe is the area we need the most improvement on?
- Out of the following 5 areas, which ones do you anticipate needing in the next year?
- Were invoices sent out on a regular basis to you?
- Were you ever surprised by the amount on an invoice?
- What are the 2 ways we could better serve you?
- Would you recommend your friends or colleagues to hire us?
- Are there any other comments, suggestions, complaints, or concerns you would like to voice? [14]

A client satisfaction survey can be conducted using two basic methods: client written response solicitations and client verbal response solicitations. Client written response solicitations involve either email or printed surveys. Client verbal response solicitations involve some form of personal interviews with clients. The methodology used should align with the goal of the survey.

When using surveys via e-mail or a website, some firms use a 3-point scale ranging from “exceeded expectations” to “met expectations” to “below expectations.” Other firms prefer more open ended responses in personal interviews so that clients can go into more depth about issues of higher importance to them.

### Email Surveys

Email surveys are the easiest to prepare and distribute, but these surveys generally yield a low number of responses from clients, lack of depth in the issues addressed and provide limited feedback from the client.

Email surveys are best used to poll a client base regarding a particular issue to gauge interest. One person noted that when he tried it, he got about a 20% response rate, which he did not consider worth his time. [7] A second attempt improved the response rate to about 45% by enlisting a corporate customer advocate to make follow-up phone calls prompting clients to respond. Another author believed clients view e-mail surveys as a token gesture, not a sincere desire to improve. [7]

### Printed Surveys

Like the email survey, printed surveys are best used for purposes other than assessing client satisfaction. Responses rates are generally fairly low, and clients don't view it as a serious attempt to connect personally with the law firm.

### **Client Satisfaction Interviews by Relationship Attorneys**

Some lawyers believe they can ask for and receive valuable feedback by engaging in a chat with a client after the service. Experts caution that this approach is dangerous because it overlooks the complex relationships between lawyers and clients. Client interviews are both art and science, and knowing what question to ask next can open or close doors to new business development. Client interviews are not just ways to make the lawyers feel good about their performance. [5]

### **Client Satisfaction Interviews by Internal Law Firm Representatives**

The client satisfaction interview when conducted properly will demonstrate to the client the firm's sincere effort to continue to meet and exceed the expectations of clients. [7] The client satisfaction interview program is more time consuming and can be conducted in various ways. Many firms will use a combination of telephone and personal meetings to conduct these interviews. Telephone interviews can be effective for basic feedback but do not demonstrate the personal commitment that is evident in the face to face meeting to conduct the survey.

The personal meeting requires extensive preparation, knowledge of the client relationship and a thoughtful list of questions for discussion. Participants in the meeting may include the relationship attorney, managing partner, Director of Marketing and Client Services, and/or a third party consultant.

The wise selection of interviewers is critical. Clients will offer different types of feedback based on their level of comfort and engagement with participants. If the interview is conducted by the relationship attorneys (the attorney with primary contact and responsibility for the client's work), the client is less likely to mention specific problems that may be of concern. Many firms will have the Managing Partner and/or the Director of Marketing and Client Services conduct the interviews. Having someone other than the relationship attorney participate in the process demonstrates firm wide commitment to the client and the working relationship.

Client satisfaction interviews should be held to a set amount of time (typically 30 minutes) unless the client willingly extends the meeting to continue the dialogue. The format of the interview will vary but the questions should demonstrate the firm's desire to improve and exceed the client's expectations.

### **Third Party Consultants**

The final approach is to hire a third party consultant to conduct the client satisfaction interviews. Firms engaging in this process work closely with the consultant to select the clients for interviews and then allow them to contact the clients directly on their behalf. Interviews conducted by consultants are summarized and reported back to the management of the firm. The surveys can also be conducted on a confidential basis (the identity of the client making comments is not revealed to the firm) in order to encourage honest and open feedback from clients. These surveys, if done properly, have the most potential to reveal areas of concern and opportunities for improving the client relationship.

The cost to engage a consultant for such a survey varies depending upon the number of clients interviewed, their locations and the scope of the survey, but could involve as much as \$20,000.

Third party consultants offer the additional advantage of being able to compare the firm's results to other aggregated results from other firms that they also survey. These results can help the firm understand where their firm's strengths and weaknesses are in comparison to others.

<b>Type of Survey</b>	<b>Pros</b>	<b>Cons</b>
E-mail Surveys	Easy to implement Relatively inexpensive process	Limited detail Often overlooked in email Lack of responses
Printed Surveys	Easy to implement	Lack of detailed feedback Low number of surveys returned
Client Interview with Relationship Attorney	Existing relationship with client	Lack of candor from client
Client Interview with Managing Partner and/or Marketing Director	Demonstrates commitment by the firm to the client relationship beyond the relationship attorney	No benchmarks from other firms
Client Interview with Consultant	Demonstrates commitment of the firm to improve client relationships and exceed expectations Benchmarks available	Process can be expensive

**TABLE 2. Types of Client Satisfaction Surveys**

### **The follow up**

The success of the client satisfaction interview process is largely dependent on the law firm's ability to process the information received, act on any areas of concern which were identified, and develop processes within the firm to improve the future delivery of legal services. Many firms undertake the process of client satisfaction interviews only to be shocked at some of the feedback they receive. The inability to deal with issues raised in the survey process can further damage the client relationship and put the firm at risk of losing the client.

Information received from these interviews should be managed from two perspectives. First, the client specific feedback is of high value to the firm and the lawyer who works directly with the client. As with all customer service models, when clients feel like you have made a good faith effort to listen to them and improve, they are more likely to recommend you to others and do repeat business with you.

Second, the aggregate information gathered from all interview should be analyzed across the firm and evaluated as to its impact on the firm's strategic goals. The information may reveal opportunities for additional work in areas of practice not currently emphasized by the firm. It may also identify potential systemic problems in the firm that the firm's management should address. [5] Firms should keep in mind that the purposes of the client satisfaction survey are 1)to demonstrate to the firm's clients that they are important and valued by the firm and 2)to improve those client relationships as needed.

### **SIX-SIGMA AT LAW FIRMS**

Over twenty years ago, Motorola introduced six-sigma as a way to improve quality by reducing errors, waste, and duplication of effort. Though few firms have embraced extending six-sigma quality improvements to law firms, Richard J. Sabat tried it among legal services at a Philadelphia-based commercial mortgage loan office. After applying the variance reduction techniques, he reduced time charges to clients by 25%. Instead of being hailed as a hero, he was reviled by fellow lawyers who asked him privately, "Are you nuts? All this does is reduce legal fees." [2]

In the service sector, quality experts monitor information instead of manufacturing effort or material. Six-sigma green belts and black belts skilled at tracking information flow can measure where errors, waste, and duplication occurs in any industry.

Sabat's efforts led him to establish handbooks outlining the precise steps associates should follow based on the level of complexity of transactions. Some loan closings or property acquisitions were simple and could be completed by support staff using automated document preparation systems. Others required an attorney's intervention.

Warren M. Krompf, chief human resources officer at Powell Goldstein in Atlanta advocates using six-sigma on a staff level to reduce waste in billing. He also sees potential for applying it among the attorney's processes. Clients who learn their attorneys are using six-sigma will see reduction in both billable hours and in errors. [2]

### **FACTORS OF HIGHEST IMPORTANCE TO CLIENTS**

A 2003 published survey showed the gaps between what clients say is important in comparison to what law firms think is important to clients. Key findings in this study:

- Clients identified breadth of services, flexibility, keeping the client informed, business acumen, understanding your company, and personal chemistry as their highest priorities.
- Law Firms in the survey believed that clients valued accessibility, responsiveness, industry (not firm) knowledge, bench strength, keeping the client informed, and breadth of services most highly.

While two of those items overlapped (keeping the client informed and breadth of services), it is clear that without directly questioning clients, law firms are guessing about what clients want. Each client is unique, and what is important to the surveyed group for this study may not apply to all clients. [4]

## **THE EXPERIENCE OF ONE SOUTHEAST LAW FIRM**

In 2006, the law firm of Leatherwood Walker Todd & Mann, P.C. located in Greenville, South Carolina embarked on a strategic planning process. The firm was considering its current market position as a firm of 60 attorneys with a single office in Greenville, South Carolina. The threshold issue for the firm was whether to maintain the single office, local practice or to expand to a regional firm with a larger geographical footprint. The legal consulting firm of Hildebrandt International facilitated the strategic planning process.

One major component of this process was to conduct formal interviews of representative sample of core clients. The goal of the interviews was to provide the firm with valuable information about key issues important to those clients in their relationship with the firm and their relationship attorneys, including areas of concern about services, trends in purchasing of legal services by clients, their level of sophistication and the changing nature of their expectations, insight into the expectations of the clients from current firms and others in the marketplace, the perceived differences between the various practices within the firm, and the perspective on where the firm is positioned in the marketplace.

### **The Process**

The law firm selected 12- 20 of the firm's top clients to participate in the interview process. Interviews were conducted in person by the designated consultant or by telephone. Interviews were conducted in a fixed time frame of 30 minutes unless the client willingly extended the timeframe.

The analysis of the interviews generated themes and information to assist the firm in their strategic planning process. Interviews were conducted on a confidential and non-attributable basis in order to maximize the candor and participation of the client. Where possible, specific issues raised in the interviews, with client permission, were conveyed to the firm.

### **The Results**

The results of the client interview process were very revealing. The clients were very forthcoming with information in the in-person or telephone interviews with the consultant. The information gathered was summarized into three major categories; service, depth of expertise and geographic presence.

In the area of client service, clients were asked to rank the firm's level of service compared to other firms with regard to responsiveness, knowledge of the matter by attorneys involved, and quality of work. The firm received high marks with regard to the service

provided by the primary relationship attorney. There was some concern expressed by clients regarding the level of service of other attorneys involved in their matters, and in some cases their appeared to be a breakdown of communication from the relationship attorney to servicing attorneys, whether partners and associates.

In the area of geographic presence, clients were asked if they thought the firm could better serve them if their geographical presence was expanded. The overwhelming response from key clients indicated that the firm should consider expanding to have a regional presence. The law firm found that many clients perceived the firm as an old-line South Carolina firm. An example of a client response is... *"a bigger footprint gives me the impression that they have deeper reach and a greater level of expertise."*

With regard to depth of expertise, the firm found that clients were concerned with only having a relationship with the primary attorney. Communication with other attorneys at various levels would give the client an increased level of comfort that the matter was being managed by the firm. A quote from a client that epitomizes this concern is, *"If 'x' gets hit by a Mack truck then we're in trouble. It's something I have to think about from a risk perspective."*

The client interview process was an integral part of the strategic planning process for this law firm. The review of the candid feedback from the firm's top clients, combined with the assessment of the goals and objectives of the firm, led the firm to develop a strategic plan that included the following goals:

- Expand geographical presence to become a southeastern law firm
- Increase the communication with clients to include attorneys beyond the relationship attorney
- Develop a level of expertise in additional key practice areas to serve the needs of key clients.

### **The Follow Up**

In August of 2008, after several years of thoughtful searching and planning, the firm of Leatherwood Walker Todd & Mann, P.C. merged with the Smith Moore LLP to form Smith Moore Leatherwood LLP. The combined firm is a regional firm with representation in 3 states (Georgia, South Carolina and North Carolina) and in six cities (Atlanta, GA, Greenville SC, Charlotte, Greensboro, Raleigh, and Wilmington, NC) and a total of 180 attorneys. Although the merger represented a critical step in achieving one of the strategic goals of the firm, the firm continues as part of the combined firm to expand its presence in the southeast and improve its relationships with its clients and the legal services it provides to them.

## CONCLUSIONS

When Deming, Juran, and other TQM advocates began their campaign to improve quality and competitiveness for organizations, they might never have guessed how far those applications would have extended today. Client Satisfaction Surveys are growing in importance to clients and professional service firms.

Each client is unique. By asking the right questions in an open environment, law firms may find surprising outcomes which can lead to improved client service and changes in the firm's approaches with specific clients. Firms must address each individual client's concerns in a timely and effective manner so that the client is happy with the outcome and persuaded that the firm is looking out for his or her best interest.

In addition to addressing individual client's preferences, the firm should compile results of client satisfaction surveys from many different clients to determine if there are compelling trends and strategic planning changes the firm should consider. Aggregated results can show strengths and weaknesses which the firm can use for ongoing validation and improvement. One firm in this study merged with another firm because of feedback from clients who wanted expanded geographical coverage. Though the merger is still relatively recent, preliminary indicators suggest that clients appreciate the firm's expanded presence.



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## RELIABILITY IN SERVICE OPERATIONS

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### ABSTRACT

Quantitative tools for assessing and improving reliability have been largely overlooked by most service managers. This paper will examine reliability tools that have been widely used in manufacturing and will develop a framework for classifying these tools. Service managers can use the proposed framework to examine the applicability of these technical tools in service operations and to guide reliability improvement efforts.

**Key words:** Service reliability, quality costs, multistage processes

### INTRODUCTION

No matter the type of service purchased, customers value service reliability. In a service context, reliability can be defined as the firm's ability to provide the service correctly the first time [6], [19], [2], [15]. Past research has shown that reliability is an essential component of service quality [16]. Despite its importance, most papers link service reliability solely with customer perceptions while foregoing mathematical analysis of service system reliability [8]. This situation is analogous to relying on customer satisfaction surveys alone to assess and improve service quality while neglecting the more mathematically rigorous tools of statistical process control.

This paper will argue that the use of technical tools for assessing and improving service reliability can offer service managers additional insight about delivering reliable services to customers. In addition, this paper will propose a framework for classifying these technical tools so that managers can better understand how to use them in practice. The following section will introduce the dimensions of the classification scheme. Section three will discuss some of the key reliability tools that have been widely used in manufacturing and explain their classification within the framework. Section three will also describe how a few of these tools have been used in actual service contexts. Section four will discuss the managerial implications of this research. The final section will address possible approaches for future research in service reliability.

### FRAMEWORK DIMENSIONS

The framework proposed in this paper utilizes two major concepts from the quality management literature to guide the classification process. The first concept deals with matching the analytical tool with the architecture of the service system that is under investigation. The second concept

involves differentiating techniques devised to prevent errors from those designed to appraise current performance levels.

Previous research in the statistical quality control literature has demonstrated the importance of understanding the architecture of a process before implementing control charts to monitor it [9], [20]. For instance, if the process consists of a single stage and only one variable is monitored, then traditional Shewhart charts are appropriate. In contrast, if the process is a multistage process in which subsequent stages are dependent on previous stages then traditional Shewhart charts can yield misleading information [9]. For such multistage processes, which are known as cascade processes, alternative methodologies like regression control charts are necessary. Similarly, in reliability analysis and improvement, some technical tools are better suited to analyzing a single feature of a single sub-process while other tools are more applicable to examining multistage processes.

While the architecture of the service system provides one means of classifying reliability tools, the notion of quality assurance offers another. Quality assurance encompasses both the appraisal of the current product or service and the prevention of errors or defects. Since reliability is an integral part of quality, one could argue that reliability assurance should also include appraisal techniques as well as error prevention techniques [3], [12]. As noted previously, these techniques should comport with the architecture of the service process; consequently, a two dimensional framework for reliability tools emerges. Figure 1 illustrates this framework which

**FIGURE 1  
A CLASSIFICATION OF RELIABILITY TOOLS**

<b>Reliability Assurance Approach</b>	<b>Prevention of Failure</b>	Standardization Redundancy Failsafe Techniques 3	Process Flow Charts Fault Tree Analysis 4
	<b>Appraisal of Failure</b>	Failure Rate Analysis Univariate SPC Charts 1	2 Network Diagrams Multivariate SPC FMEA Root Cause Analysis Ishikawa Diagrams Pareto Analysis
		<b>Single Stage</b>	<b>Multistage</b>
<b>System Architecture</b>			

identifies four categories of reliability tools: 1) performance appraisal tools for a single stage or sub-process, 2) performance appraisal tools for a multistage process, 3) error prevention tools for a single stage or sub-process, 4) error prevention tools for a multistage process.

In the next section, the proposed framework will be applied to a set of well known reliability tools. While these tools are common to manufacturing contexts, they can also provide insight in service contexts – provided they are properly applied.

## CLASSIFICATION OF RELIABILITY TOOLS

As Figure 1 illustrates, there are four categories of reliability tools in the proposed framework. This section will discuss each of the four categories in turn, beginning with category one which deals with appraisal tools for single stage processes.

Quantitative analysis of the reliability of a single stage or sub-process traditionally centers on two key performance measures: error (or failure) rate and consistency. In a manufacturing context, the failure rate for a product – denoted by  $\lambda$  – can be defined as the ratio of the number of failures to the total unit operating hours. Gunes and Devici [8] adapted this ratio to study the error rate in reporting examination scores at a university office. They used the following formula to compute  $\lambda$ :

$$\lambda = \frac{\text{Total Count of Weighted Failures}}{\text{Total Number of Questions on all Examination Forms}} \quad (1)$$

Reliability of the score reporting process was defined as  $(1-\lambda)$ . Gunawardane [7] noted that while this approach is appropriate for single stage service processes it cannot by itself capture the complexity of the system architecture of multistage processes.

A similar argument can be made for the use of traditional Shewhart control charts for monitoring and controlling reliability metrics. For instance, Apte and Reynolds [1] used the range chart to monitor wait time variation at a drive-through window at a quick service restaurant; however, a single range chart cannot adequately depict variation in a multistage process [9]. In such processes, performance at the final stage may depend on performance at earlier stages of a cascade process or may result from the confluence of multiple service flows. In such cases, multistage control chart techniques are needed to assess the reliability metric [11].

The second category of the proposed framework contains tools for appraising reliability in an entire multistage system. While all of the tools in this category can be used to study overall system performance, some are especially useful for understanding the effect of system architecture on reliability.

Perhaps one of the most basic tools for analyzing the impact of system configuration on reliability is the network diagram [7]. This approach decomposes the service system into sub-processes, each of which operates either in series or in parallel with other sub-processes (see Exhibit 1). Overall system reliability can be estimated using the network diagram in conjunction

with the reliability formulas for series design and parallel design. For example, suppose a beverage service in a full-service restaurant consisted of three stages:

- 1) The server takes the beverage order at the table after the customers are seated and before the order is taken. This part of the service is the responsibility of the server assigned to the table.
- 2) In the second stage of beverage service, the server delivers the drink order to the customers at the table. The servers are responsible for either filling the order themselves or picking the order up when it is ready at the bar.
- 3) Stage three occurs during the consumption of the meal as the server checks back to ensure that the drinks are maintained.

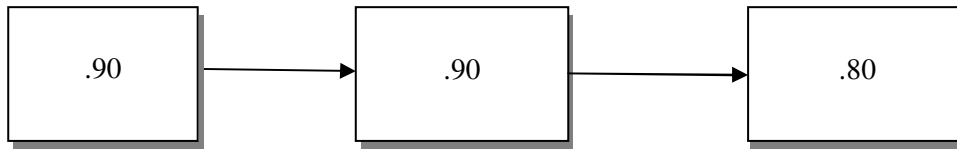
As Exhibit 1 shows, if the stages operate at 90%, 90% and 80% reliability, respectively, then the in-series system reliability is only 64.8%. The poor performance at the third stage lowers the system reliability for the whole beverage service. If a backup is put in place for the third stage, the reliability of the problem stage would be improved (and the reliability of the entire beverage service would also improve). For instance, a floating server could be charged with checking beverage levels for the entire dining room as a backup to the individual servers. Even if the reliability level of the backup is lower than the reliability of the server alone (for example, .60 compared to .80 for the server, as shown in Exhibit 1), the result is increased reliability for that stage of service (to 92% from the original 80%). The improved third stage will also improve the reliability of the entire beverage system (an increase to 74.5% from the original 64.8%). This increase in system reliability represents a 14.97 % increase in the reliability of the system ( $.745 - .648 / .648$ ).

A second tool that utilizes system architecture is the multivariate statistical process control chart. This approach is applicable when a service needs to monitor and control at least two related metrics simultaneously [14], [11]. In many services consecutive stages are not independent of one another; instead reliability at an upstream stage affects reliability at a downstream stage. This system architecture can create a natural hierarchy in the reliability metrics for each stage, since the output for a preceding stage constitutes the input for a subsequent stage. In such cases, Mandel's [13] regression control chart and Zhang's [22], [23] cause-selecting control charts can help to determine if variation in reliability metrics is predictable within limits or if unnatural variation is occurring in the reliability metric.

Yet another tool that utilizes system architecture is the Failure Mode and Effects Analysis (FMEA) technique. A key feature of this technique is the system block diagram which shows all component sub-systems, identifies the series and parallel relationships among the sub-processes and describes the inputs and outputs of each sub-process [5]. The block diagram can be used together with statistical data from each sub-process to determine why the overall system is unable to meet a reliability goal [12]. Dhillon [5] has enumerated a number of benefits of FMEA. These include: 1) an organized methodology for studying service failures, 2) improved communication about service design, 3) improved customer satisfaction and 4) a potential source of safeguards against future mistakes that could lead to service failures.

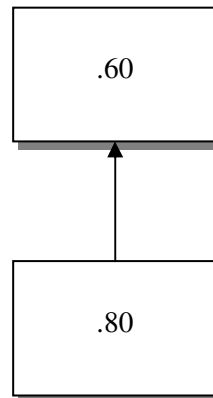
## EXHIBIT 1 RELIABILITY CALCULATIONS

Original In-Series Reliability:



$$\begin{aligned}R_s &= R_1 \times R_2 \times R_3 \\R_s &= .90 \times .90 \times .80 \\R_s &= .648\end{aligned}$$

Parallel Reliability:



$$\begin{aligned}R_s &= R_1 + (1 - R_1) \times R_2 \\R_s &= .80 + (1 - .80) \times .60 \\R_s &= .80 + .12 \\R_s &= .92\end{aligned}$$

Revised In-Series Reliability:

$$\begin{aligned}R_s &= R_1 \times R_2 \times R_3 \\R_s &= .90 \times .90 \times .92 \\R_s &= .745\end{aligned}$$

In addition to the techniques that utilize system architecture directly, there are other techniques which can help a manager appraise the reliability of an entire service system. The first is root cause analysis (RCA), which can be used to determine why a particular service failure has occurred. Root cause analysis investigates the event sequence that led to the failure. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has recommended the use of RCA by health care facilities responding to sentinel events [5]. Dhillon [5] notes that JCAHO requires that the RCA analysis must begin with an investigation of special causes in clinical operations and proceed to common causes in organizational processes.

The Ishikawa diagram (or fishbone diagram) can also be used to determine causes of service failure. This approach traces problems to four possible sources: 1) manpower, 2) method, 3) machine and 4) material. Wyckoff [21] illustrated the use of the Ishikawa diagram to trace the causes of delays in pushback (moving an aircraft away from the gate) at Midway Airlines.

The final appraisal technique in category two is Pareto Analysis. This technique is based on the premise that most reliability problems stem from a small set of causes [12]. A frequency distribution or Pareto Diagram is constructed by totaling the number of service errors that result from each of the possible causes of reliability problems. The diagram can help the service manager identify those few causes that led to the greatest number of errors. By monitoring these causes, a service should be able to maintain or even improve reliability [12]. Wyckoff [21] applied Pareto analysis in his study of service problems at Midway Airlines. He found that nearly 90% of late departures stemmed from only four causes.

In contrast with the techniques found in categories one and two, the methods listed in categories three and four are aimed at prevention of reliability problems rather than measurement of performance. Many of these prevention techniques are adaptations of methods that are widely used in quality assurance.

As shown in Figure 1 there are three prevention techniques that are especially useful for single stage analysis. The first of these involves poke-yoke or failsafe procedures. Failsafe techniques consist of devices and control mechanisms designed to help workers and/or customers avoid or immediately correct mistakes that could lead to reliability problems [4]. For instance, in a rural paratransit system studied by Sulek and Lind [18], the number of rider no-shows and riders not ready for pickup at the scheduled time was reduced when the dispatcher phoned each rider the night before the scheduled trip to remind him or her to be ready at the scheduled time. This was an important failsafe solution to the problem of schedule creep, which can lead to greater delays in rider pickup and delivery as the day progresses.

The second technique in category three involves standards. Just as operating standards can help ensure service quality, so can they also help to promote service reliability. For example, KFC (Kentucky Fried Chicken) radically reduced the standard for wait time at drive through windows to 60 seconds to remain competitive with other quick service restaurants with drive through service. Despite the fact that the new standard was not advertised, drive through business increased substantially [1]. Similarly, Wyckoff [21] delineated operating standards used by Rusty Pelican restaurants; these included a 4 minute standard for making a request for orders

once beverages are served, a 16 minute standard for serving the entrée after the order is placed and a 4 minute standard for presenting the check after dessert is served.

The final technique in category three deals with redundancy in service design. This approach recognizes the fact that backup systems and processes can safeguard reliability should unexpected failures occur. For instance, Kwortnik [10] reported that only 48% of hotels in his study maintained emergency power during the 2003 blackout on the Eastern seaboard. The consequences of inadequate backup power systems were numerous and included: 1) lack of air conditioning, 2) lighting problems, 3) unreliable elevator service, 4) inability to make new keys for guest rooms, 5) unavailability of computer systems, 6) frozen automatic exit doors, and 7) disabled communications systems.

Category four extends the concept of prevention of errors and failures to a system-wide effort. Two approaches are well suited to system-wide analysis. The first of these involves process flowcharting to identify possible failure points. Shostack [17] adapted flowcharts to service operations; her technique is known as service blueprinting. Shostack [17] argued that many problems with service delivery can be anticipated and worked out on paper before they materialize in practice. Wyckoff [21] also advocated the use of step by step flow charts as a starting point for controlling quality in his restaurant study. Wyckoff [21] expanded a summary flow chart to detailed examination of each step with corresponding performance specifications.

The second method found in category four is fault tree analysis. This method begins with system definition and the identification of the system failure (or “top fault event”) to be studied [5, p. 310]. A logic tree format and fault tree symbols are used to represent all possible causes of the system failure. The tree can then be analyzed to gain insight on failure modes and the relationships among fault paths [5].

Each of the methods discussed in this section can provide insight on reliability in a service setting; however, there is more than one natural progression in the application of these tools to services. The idea of progression in application is discussed in greater detail in the next section.

## **DISCUSSION**

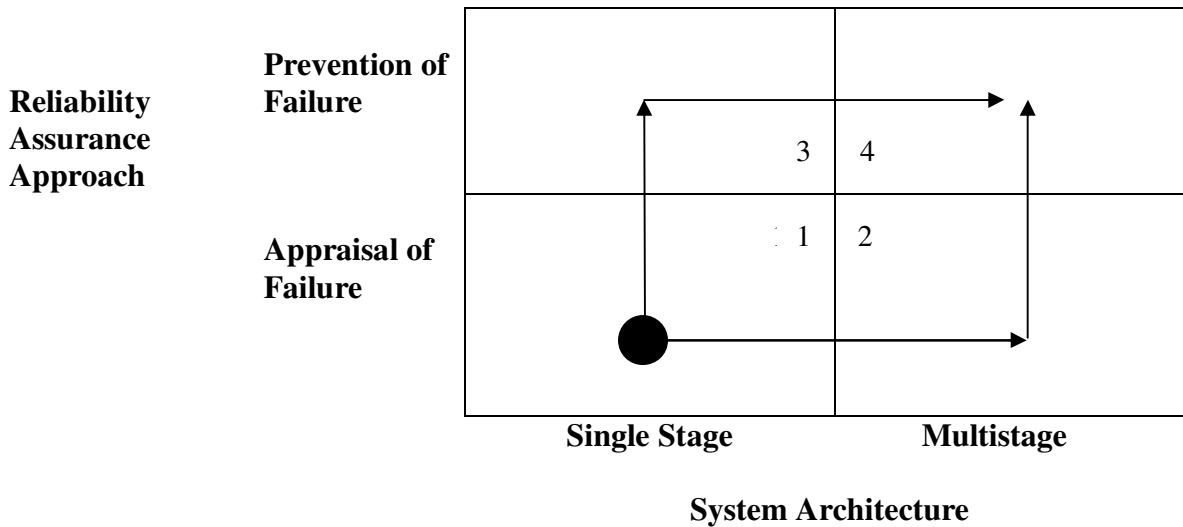
The previous section has described the reliability tools that comprise the four categories of the proposed framework. This section will focus on the order in which a service manager applies various types of reliability tools and the consequences of the selected order of application.

Figure 2 illustrates that there is more than one way to sequence the application of tools from different categories. One possible sequence consists of a progression from category one through category two to category four. Such a progression implies that a manager should begin his investigation of reliability at his service operation by measuring performance at individual stages. For instance, error rates for individual stages or service components could be calculated from operating data. These error rates could be used to calculate reliability for each stage. The next step in this particular progression would require combining the reliability of system components into a single metric for system reliability. FMEA could then be used in conjunction



with the statistical data collected for each stage to determine why a service system has failed to meet the desired level of reliability. Of course, improving reliability must move beyond finding reasons for current failures. It is also necessary to anticipate errors that may not have yet occurred. This implies that techniques from category 4 may prove useful since these tools allow the manager to consider – in advance – the consequences of altering the service design to prevent a possible service failure.

**FIGURE 2  
IMPLEMENTATION OF RELIABILITY TOOLS**



Another possible application sequence that is apparent in Figure 2 involves progression from category one thorough category three to category four. This particular progression also starts with an assessment of reliability at the component or individual stage level; however, it then centers on finding ways to prevent the individual errors at each stage. The progression concludes with a transition from single stage error prevention to system-wide error prevention. Unlike the first progression, which is driven by measurement and quantitative analysis, the second progression relies on more on the judgment and experience of service workers and their managers. Because the second progression involves a larger subjective component, it may be naturally more subject to bias problems than the first sequencing [5]. On the other hand, it may provide a richer understanding of the ways in which workers make mistakes and how these mistakes can be prevented.

### CONCLUSION

This paper proposed a classification scheme for reliability tools which have been widely implemented in manufacturing contexts and which could also be applied to service contexts. The proposed framework classified tools on two dimensions: 1) quality assurance, which

includes both prevention and appraisal techniques and 2) system architecture, which encompasses both single stage and multistage methods. The proposed framework was then used to explain possible sequences of tool implementation to achieve reliability improvement in services. The two progressions suggested in the preceding section are not necessarily the only ones that are possible. Obviously, additional research will be needed to test the effectiveness of these sequences and other possible progressions in actual service settings.

In addition, future research could address the issue of customer perceptions and customer feedback as part of the reliability appraisal process. Such an extension would parallel the work on quality improvement which combines statistical analysis of operating data with perceptual data obtained from customer input. A combined approach may lead to a better understanding of what reliability improvement means in service operations. However, as the framework in this paper has illustrated, the reliability tools that originated in the manufacturing sector provide a useful starting point for improving service reliability.

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The Relationship of Organizational Context to Quality Performance: Assessing U.S. Hospital's Patient Safety Outcomes Utilizing Publicly Available Data

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In an effort to augment the discussion related to the extent to which quality is universal, this study presents the results of an analysis of 13.5 million 2004 inpatient discharges from 1,526 general hospitals from 16 states utilizing the Agency for Healthcare Research and Quality's (AHRQ) Patient Safety Indicators (PSIs) and State Inpatient Databases (SID). After eliminating low volume and outlier hospitals, factor analysis was performed on 697 hospitals (representing over 8 million discharges) using principal component analysis with Varimax rotation and the 14 Surgical and Medical/Surgical PSIs were reduced to 5 factors: 3 surgical and 2 medical/surgical. The resulting factor scores were used to rank the hospitals according to deciles and the composite decile scores were used to group the hospitals into 5 tiers or groups ranging from 123 to 155 hospitals. Hospital groups were profiled utilizing hospital demographic variables (e.g. size, patient mix, teaching, rural/urban, ownership, accreditation status) available from the American Hospital Association (AHA) Annual Survey Database FY 2004 Edition. Contrary to expectations hospitals in the highest tier (best quality performers) tended to be smaller, non-teaching hospitals whereas larger, teaching hospitals tended to be in the lower tiers (poor quality performers). One explanation for this might be that since larger teaching hospitals tend to have more complicated cases does not seem to fit when one considers that these are measures of errors or mistakes rather than measures of quality outcomes which may be more influenced by case complexity. Other explanations of these findings could range from one extreme that says patient safety may tend to be better in smaller hospitals because better controls can be maintained than in larger facilities due to issues of diseconomies of scale to another that says that the quality of data from smaller hospitals is poor because these hospitals do not have the resources to adequately code their claims in enough detail to identify patient safety instances. Regardless of which of these explanations may fit, this analysis has provided evidence patient safety quality rates may be influenced by the organizational context. Quality may not be universal (or at least the measurement of patient safety as an indicator of quality outcomes using these data bases and measures may not be) and so care must be taken in interpreting these findings. These findings suggest that organizational context may be an important influencing factor, so future studies need to focus on comparing resulting using: risk adjusted measure as well as more similar hospitals relative to size and teaching status. These findings build upon

existing quality management theory, and illustrate the use of available secondary quality data resources and tools in the most important healthcare industry which composes 17 percent of the GDP.

# **The Dual Identity of Decision Sciences Courses: Learning Style Considerations in the Online Environment**

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## **ABSTRACT**

The Internet has led to expanded offerings of a range of courses in various disciplines online. However, the interplay of student and teacher learning styles, course content and the online instructional delivery method needs further study. This is particularly true in the decision sciences (e.g., operations management, quantitative methods, and management science), which typically reside in the business school curriculum yet function as a conduit between two worlds – engineering and management. We review literature from a growing body of research in management and engineering education that demonstrates how an awareness of individual learning styles can aid in designing instructional approaches and learning activities to increase student retention, satisfaction, and academic performance. We argue for studies that specifically explore the implications of various learning styles in the decision sciences and offer avenues for future research.

## **1. INTRODUCTION**

The use of the Internet for delivering web-based coursework has become a preferred method of instruction in distance education, particularly in higher education. The number of students enrolled in online courses and the increasing availability of distance education reveal the growing importance of this method of instruction.

According to statistics from the *National Center for Education Statistics*, in the 2006-07 academic year, there were an estimated 12.2 million enrollments in college-level credit granting distance education courses (see Parsad & Lewis, 2008). Of these 77 % were reported in online courses and the remaining in blended or other types of distance education courses. Distance delivery of curriculum content is now becoming a standard medium for supplementing or replacing traditional classroom teaching (Drago et al., 2002) and there is no indication that a plateau has been reached.

Certainly the development of innovative internet technologies has contributed to the growth of online learning. However, while innovative technologies are necessary to the development of online course delivery, they are not sufficient to assure that distance education is effective. Online course delivery poses a whole set of new problems that must be properly addressed. Moreover, despite the increased growth and interest in online education, research surrounding its effectiveness is sparse (Hay et al., 2004a; Martins & Kellermanns, 2004; Zapalska & Brozik, 2006). Regrettably, little is understood about how to best plan, implement, and evaluate online

courses (Peltier et al., 2003). Clearly, pedagogical theories and approaches to effective teaching in online learning environments are needed (Arbaugh, 2002).

One longstanding pedagogical theory that most educators support, is that students learn in different ways. Since every university desires to have successful students, knowledge of how student learning style differences impact their success would be useful. In fact numerous published research studies (Gregorc, 1985a; Messick, 1976; Biberman & Buchanan, 1982; Wynd & Bozeman, 1996) exist that explore the impact of LS differences in the traditional face-to-face classroom. Many of these studies reveal that instructional approaches along with pedagogical activities that consider individual LSs can have a positive impact on student success. However, relatively few published studies have critically evaluated the influence of individual LSs on learning outcomes in an online environment.

Given the growth of distance education course offerings available online, there is a pressing need to extend LS research to this delivery platform. As educators continue to become aware of the critical need of understanding how individuals learn, they will be better equipped at integrating characteristic elements of various LSs to enhance the learning experience.

## **2. MOTIVATION**

The motivation for our research is captured in Figure 1. Specifically, we argue that there is interplay among four key factors that contribute to student success (defined in terms of retention, satisfaction, and academic performance). These factors are the: 1) teaching style of the instructor 2) LS of the students, 3) instructional delivery mode, and 4) course content. For the purpose of our study, much of the discussion focuses on an Internet based delivery mode for courses in the decision sciences (e.g., operations management, quantitative methods, and management science). We contend that such courses pose a particularly unique challenge to the faculty developer because they have a dual identity. Specifically, the content of courses in the decision sciences is rooted in engineering yet the course is intended for business school students. We argue that this issue creates distinct pedagogical considerations and challenges for these courses that warrant additional study and examination.

Ignoring the diversity of learning orientations of students can yield negative consequences. In fact, research suggests that student success can often be directly linked to the relationship between a student's LS and the chosen method(s) of delivery of course content (Gregorc, 1985a; Messick, 1976). Thus, it is vital that instructor-selected methods of delivering course content are broad based and not limited to their own ways of learning. A first step in this direction is for faculty to be aware of their own learning preferences and the fact that their propensity to learn may not be aligned with the LSs of all of their students.

Coupling LS implications with the online course environment presents additional considerations. Online courses by their very nature are a unique form of course delivery. Many of the traditional methods of delivery in a brick and mortar classroom do not transfer well to a web-based environment. Therefore, online course delivery may have unique issues regarding how students learn and consequently their success in a course. Considering individual learning style

preferences in distance education may assist in removing potential learning obstacles within the online environment.

Our work seeks to augment a growing base of literature that is focused on online course development for greater student success. Our objective is twofold. First we endeavor to provide a review and analysis of relevant literature focused on LSs in management and engineering education, the two disciplines linked to the decision sciences. Our second objective is to provide research propositions that can be used as the starting point for future research to help isolate factors and activities related to LS theory that facilitate more effective learning in online courses in the decision sciences.

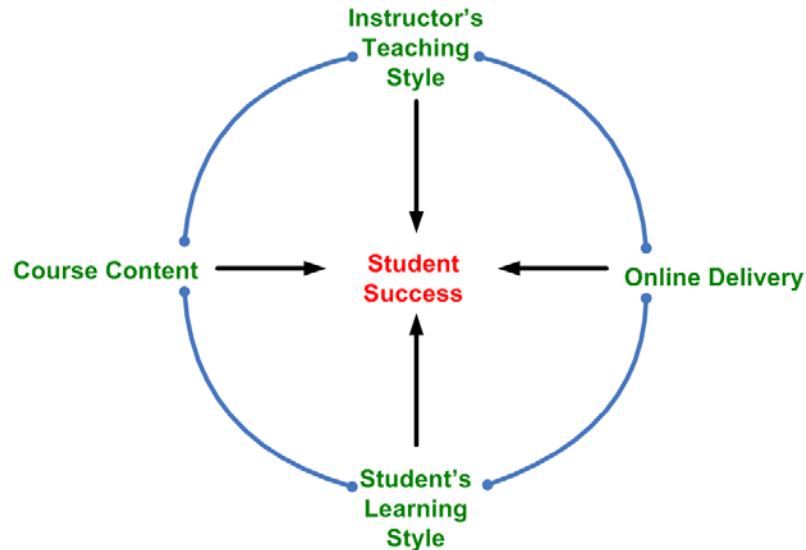


Figure 1: Factors Impacting Student Success

The paper is organized as follows. We first define the concept of a LS based on several widely published descriptions in the open literature in section 3. In section 4, we discuss pertinent studies of type effects in management and engineering education and summarize these implications for each respective discipline. In section 5, we compare and contrast the curriculum norms in management and engineering education and discuss the implications for decision sciences courses in the business school environment. This section also offers directions for future research. Finally, in section 6 concluding statements are provided.



### 3. LEARNING STYLES

The extant literature offers a plethora of definitions of LS, with an undoubtedly extremely rich but fragmented theoretical landscape. Keefe (1979) offers a well designed and often benchmarked definition of LS: “LSs are characteristic cognitive, effective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment”. Dunn et al., (1981) described LS as a way in which the individual takes in new information and develops new skills. Campbell et al., (1996) described a “certain specified pattern of behavior according to which the individual approaches the learning experience”. Kolb, (1984) suggested that the process of acquisition was key, defining learning as “the process by which the individual retains new information or new skills”. Felder (1996) defines LS as the “characteristic strengths and preferences in the ways they [students] take in and process information”. The distinctive LSs that influence our preferred ways for perceiving, organizing and processing information have, in fact, received much attention from disciplines such as psychology, management and education. However, the lack of a unified theoretical and analytical framework in the resulting literature has left many educators with the question of how to use LS theory effectively in the classroom.

For the purposes of this paper, a LS is defined as consistent preferences for gathering and understanding information (Messick, 1984; Riding & Rayner, 1997). This approach to learning emphasizes the fact that individuals perceive and process information in very different ways. LS theory implies that how much individuals learn has to do with whether the educational experience is geared toward their particular style of learning.

There are numerous LS models currently available. Researchers indicate that “some 21 models of LSs are available in the open literature” (Eom & Wen, 2006). Sandman (2009) lists over 25 different LS assessment tools. Hawk and Shah (2009) review five (Kolb, Gregorc, Felder and Silverman, VARK, and Dunn & Dunn) widely available LS instruments and classify them according to their common measures and differences and recommend selection of a particular instrument under various conditions including cost, the validity and reliability of the instrument, the LS dimensions covered, and the time necessary to administer the instrument. Although there is no single commonly accepted LS model, most of the scales and classification of existing models are more similar than dissimilar. Nevertheless, the lack of a conceptual framework for both LS theory and its measurement is a common and central criticism (see Coffied et al., 2004).

While any attempt to integrate such varied classifying models of LSs into a coherent, all encompassing framework would undoubtedly represent an overly ambitious task, what these different perspectives do share is the underlying rationale that everyone cannot be taught in the same way. It follows that teachers should take LS differences among students seriously. However, Felder and Brent (2005) posit that faculty should not get hung up in the selection of a particular LS instrument. The authors argue that the purpose of identifying the learning preference of students is to develop a balanced approach to teaching. Thus, Felder and Brent (2005) encourage faculty to familiarize themselves with a LS model and focus on designing instruction that hits all of the dimensions of the model. There is a high likelihood that at least some of the students will fall into each of the defined categories.

They further argue that the purpose of using type theory is not to teach students in their preferred teaching style all of the time. In fact, it is rarely feasible to tailor instruction to each individual student's learning preference due to class size. Felder et al. (2002) asserts that instruction should aim to teach students in the style they prefer to encourage learning but also in their less preferred model to mature additional skills necessary for career success. Moreover, students with knowledge of their own preferences are empowered to use various techniques to enhance learning, which in turn may impact overall educational satisfaction. This ability is particularly critical and useful when an instructor's teaching style does not match a student's LS.

#### **4. LITERATURE ANALYSIS**

Numerous studies have undertaken the task of presenting empirical evidence that demonstrates the important link between teaching and learning styles. Our main focus is to explore LS implications in the decision sciences. To the best of our knowledge, there are no published studies that investigate the impact of personality or LS traits on student retention, satisfaction, or academic performance for courses in the decisions sciences in the traditional brick and mortar classroom or within an online environment. However, numerous research studies exist in engineering and to a lesser extent in management education regarding student learning characteristics that help explain student success. Since courses in the decision sciences generally co-exist as part of a business school curriculum, these courses serve as a conduit between the two worlds of engineering and business. We aim to present select empirically-based longitudinal studies in management and engineering education that investigate the potential interaction of student LSs and success. We note that although there is a growing body of research on LSs in engineering and management education in the traditional brick and mortar classroom, empirical studies focused on the online delivery mode, LSs, and student success are scant.

##### **4.1 Learning Type Differences in Management Education**

In this section we review some of the major empirical findings in the LS literature specifically related to management education. Management education consists of a broad array of qualitative (e.g., organizational behavior, strategy, marketing) and quantitative (e.g., finance, accounting, decisions sciences) courses. Rather than provide an exhaustive analysis of LS research within distinct majors in business, we isolate research studies analyzing student success in management education across numerous courses (qualitative and quantitative) and degree majors. See table 1 for a summary of this research literature.

Author and year	LS Instrument	Sample	Results of the Study
Loo (2002)	Kolb LSI	437 Canadian undergraduate business students	Students were classified based on their degree major – hard (accounting, finance, MIS) or soft (human resource management, organizational behavior, marketing, general management). Chi-square tests indicate that a student’s learning style is dependent upon the hard/ soft business major classification. Specifically, a higher number of assimilators were hard (41.9%) versus soft (29.6%) majors. Similarly, a higher proportion of accommodators were observed in soft (20.6%) versus hard (14.2%) majors. Additional chi-squared tests reveal statistical significance on gender and the hard/ soft business major. Specifically, a higher proportion of males versus females were in hard majors.
Fallen (2006)	MBTI-based instrument	148 Norwegian business students were surveyed in the fall of their second year	Aim of the study was to determine how type preferences influence student’s selection of majors and elective courses at the Trondheim Business School. Quantitative courses mostly follow a standard lecture-based presentation whereas qualitative courses follow a problem-based learning (PBL) orientation (e.g., case method). The majority of students with a sensing-judging (SJ) trait opted for quantitative disciplines, whereas students with sensing-perceiving (SP), intuitive- thinking (NT), and intuitive-feeling (NF), traits selected qualitative disciplines and courses.
Whittingham (2006)	RightPath6®	112 MBA students enrolled in at a private AACSB accredited college in the U.S.	Study explored the impact of personality type and prior academic ability indicators (undergraduate GPA and GMAT) on student performance in quantitative and qualitative courses in a MBA program. Two separate response variables are defined, QualGPA, and QuantGPA, representing GPA averages in qualitative and quantitative courses. Regression results indicate that the five personality variables do have predictive power on student academic performance in qualitative versus quantitative courses and that the impact of personality may differ according to gender. The author calls for additional investigation across the MBA curriculum on the potential personality bias in the use of various assessment methods (case study, essay questions, problem sets, etc.).

**Table 1: Learning Style Research in Business Education**

At its core, the research on student LSs in management education points to a link between personality and learning traits and student performance. It is particularly important to highlight that personality and learning attributes play a role in student performance based on whether the course content or degree major is qualitative or quantitative in nature. This presents a significant challenge in understanding the complexity of LS traits and student performance in management education especially given the mix of qualitative and quantitative degree majors, course requirements, and elective options. Management educators are more likely to encounter a wider range of students with different LSs and thus further study is needed to understand the impact of student preferences within the business school educational setting.

#### **4.2 Learning Type Differences in Engineering Education**

It is documented that attrition rates in science, technology, engineering, and mathematics (STEM) disciplines and courses need attention and improvement (Chubin et al., 2008). In a three-year, multi-campus study, Seymour and Hewitt (Seymour & Hewitt, 1997) explore reasons why undergraduates of above average ability transition out of STEM disciplines. One of the main conclusions reveals that switchers and non-switchers did not differ based on individual ability but were distinguished by their ability to cope with traditional teaching practices and attitudes in STEM disciplines. Thus, the central concern of students was pedagogical. This finding coupled with the known high dropout rate of online learners (Carr, 2000; Jones et al., 2004), must be of high concern for those offering or planning to develop online courses in STEM-related disciplines. Consequently, it is important for faculty to keep student learning diversity and retention in mind.

Considerable research has been done in the engineering sciences to assess the impact of instructional delivery and LSs on student success. In fact, this literature stresses that there is often a mismatch between the LSs of students and the traditional lecture-style classroom environment that is particularly pervasive in the engineering sciences (Felder & Silverman, 1988; Felder et al., 2002; and Felder & Brent, 2005). Students whose learning preference deviates from the lecture-style norm are at risk of dropping out or at a minimum perform poorly. Table 2 summarizes a select number of longitudinal designs studying the relationship between LSs and student performance in engineering education.

Author and year	Learning Style Instrument	Sample	Results of the Study
Felder et al. (2002)	MBTI	Tracked 116 students in 5 consecutively taught (by Felder) chemical engineering courses at NCSU.	Five consecutively taught courses were taught with more active and cooperative learning and an inductive presentation of material. Results of the study support expectations from type theory. Traditional engineering instruction favors introverts, thinkers, and judgers. However, the historical disadvantage of certain learning types was improved with students from the experimental approach.
Bernold et al. (2007)	LTM adapted from Kolb's LSI and MBTI	Tracked 1022 freshman engineering students at NCSU for 3 years.	<p>The results confirm observations from previous research (Felder et al., 2002). That is, within a traditional lecture-style learning environment, students with learning preferences aligned with abstract thinking and forming judgments based on verifiable data (LTM 2) or preferring objective thinking (LTM 3) outperformed students with a preference for divergent thinking, innovation, and creativity (LTM 1 and LTM 4).</p> <p>The curricular status (GPA and specific course grades) of students at the end of their third year is used to help uncover learner characteristics that yield the opportunity and decision to persist with engineering education. Students with the LTM 2 learning category had the highest GPA and matriculation rate while students in LTM 1 and LTM 4 struggled with lower grades and higher attrition rates.</p>
Hargrove et al. (2008)	Kolb LSI	Surveyed 232 engineering freshman over 5 semesters taking an introductory engineering course.	The introductory course is taught using a varied pedagogical mix of lectures and active learning experiences yet statistical tests for the entire cohort reveal that freshman year GPAs vary with LSs. Convergers (best at abstract conceptualization and active experimentation) achieved the highest GPAs and divergers (concrete experience and reflective observation) earned the lowest. Results substantiate the findings from four distinct institutions (University of Texas, Oregon State University, Brigham Young University, and Vanderbilt University).
Kaminski et al. (2005)	Kolb LSI	Surveyed 400 students within an introductory thermal-fluids course over three years.	The majority of the student's perceived learning characteristics fall into the category of convergers (51%) followed by assimilators (29%), accommodators (11%), and divergers (9%). As expected, end of course grades of the dominant learning type (convergers and assimilators) were higher than those of the less dominant learning type (accommodators and divergers).

**Table 2: Learning Style Research in Engineering Education**

Taken together, the research on LSs in engineering education clearly indicates that students' learning characteristics influence successful learning in traditional engineering education. Specifically, those learning preferences that enjoy abstract thinking and problem solving and enjoy working mostly alone are advantaged in traditional engineering education. The aforementioned observation coupled with the unique dependency in engineering education on cumulative knowledge can put students who absorb less or learn inadequately at a disadvantage potentially contributing to the current trend in declining enrollments in the engineering and mathematical sciences (Kaminski et al., 2005). This research has important implications for engineering educators whose aim should be to attract and retain a diverse group of personality and learning types to the discipline. Such efforts increase the pipeline of engineering professionals with varied skill sets to solve an array of complex problems that are often ill-formed and require flexibility, innovation, creativity, and divergent thinking to solve.

## **5. RESEARCH NEEDS**

The diversity of students entering higher education together with the growth in distance education, presents a pressing need for additional research in understanding how LSs impact learning outcomes in the online teaching modality. We were not able to find any published studies that systematically examine the LSs of students taking face-to-face or distance education courses in the decision sciences (e.g., quantitative methods, operations management or management science) offered in a business school environment. Since the pressure to add or enhance distance education opportunities for students continues to increase and no course can be ignored, instructional designers must rise to the challenge of providing instructional material that meets multiple LSs.

### **5.1 Management and Engineering Curricular Differences**

The typical undergraduate management curriculum consists of coursework in the basic business areas such as accounting, finance, marketing and operations with additional courses in organizational behavior and strategy. Management majors are taught to be generalists and thus a curriculum focus of breadth over depth of knowledge is prized. In contrast, engineering students take courses in the basic sciences such as chemistry, physics, and mathematics, with the bulk of the courses concentrating in the major field of engineering. Engineers are trained specialists and must exhibit technical competencies to contribute towards technology creation in a given product or service sector. As a result, the engineering curriculum focuses on depth over breadth with much of the coursework centered on detailed scientific training. With continued matriculation toward a degree, engineering students expect their coursework to be more homogenous and specialized in contrast to the management student who expects a more heterogeneous and diverse curriculum.

Courses in the decision sciences are predominately found in business school curriculums. Such courses are intended to expose students to many of the powerful decision-making tools of the discipline and the inter-relationship of the decision sciences with other disciplines. Business students typically focus on technology utilization and interpretation rather than rigorous theoretical foundations necessary for technology creation. However, courses in the decision sciences stem from an industrial engineering root, thus giving them a dual identity.

Given the voluminous literature that exists in engineering education relating LSs and student success, it seems logical that work of this nature extend to courses offered outside of an engineering school yet heavily grounded in engineering content. In addition, a large number of faculty teaching decision sciences courses in business departments were trained in engineering and technical business programs where certain learning types are historically advantaged as indicated by the literature. Professors often teach in a manner similar to how they were taught and in which they feel most comfortable. This may be at odds with the preferred LS of a significant portion of management students.

Traditionally business students have shown apathy toward courses in the decision sciences due to a lack of knowledge, limited exposure to the discipline, and difficulty with the quantitative aspect of the course. In fact, faculty involved with academic advising may notice a greater likelihood among business school students to drop quantitatively-oriented courses and to devote more time “shopping” for the right professor for such courses. In the same light, faculty involved with teaching courses in the decision sciences may also notice that students have had multiple unsuccessful attempts at passing these classes which can perpetuate a student’s feelings of the course being a necessary evil to be tolerated and not a critical and useful component of management education. Students need to be educated about the value of “operations” and “decision sciences” – labels that are much less recognized than accounting, finance, and marketing within business.

We contend that a large component of student dissatisfaction and lack of success in decision sciences courses is pedagogical. This dissatisfaction may be exacerbated by the online environment and should be a source of concern for the faculty developer. Research has been conducted indicating that successful distance education students favor an independent learning environment, a hallmark of distance education courses (Kerr et al., 2006). Online courses tend to be based on lectures, reading, and writing. Students who are more uncomfortable with these skill sets or who may need more interaction through concrete experiences might be disadvantaged. With students dropping online courses at higher rates than traditional face to face courses (Carr, 2000), those courses carefully designed to account for LSs can be an important retention tool. Thus, we argue for researchers to explore the impact of personality and learning types in decision sciences courses in online environments. It is clear from the review of literature that diagnostic use of both student and teacher LS information can be useful and in turn should influence the pedagogical mix of learning activities and approaches. The following propositions are offered as avenues for future research.

1. Decision sciences education that accommodates individual LS differences by incorporating appropriate instructional and learning strategies will result in higher levels of student satisfaction in an online course.
2. Decision sciences education that accommodates individual LS differences by incorporating the appropriate instructional and learning strategies will result in higher retention rates of students in an online course.

3. Decision sciences education that accommodates individual LS differences by incorporating the appropriate instructional and learning strategies will result in higher levels of student academic performance in an online course.
4. Making students aware of their LS strengths and weaknesses while exposing them to multiple instructional methods and strategies will allow students to learn how to learn in their less preferred styles.

We concur with Hawk and Shah (2007) that administration of at least one LS instrument should take place as close to the start of the semester as possible. Obtaining student personality and/ or learning traits early allows the instructor to incorporate learning diversity at the beginning of the course. Again, we emphasize that the goal is not to teach students in their preferred modality all of the time. Doing so, would not present meaningful opportunities for students to strengthen their learning ability in their less preferred modality. However, as Felder et al. (2002) asserts educators should avoid making learning so uncomfortable for specific temperaments that it inhibits their ability to learn and succeed.

## **6. SUMMARY AND CONCLUSIONS**

In closing, understanding LSs is important in any educational setting and theories about how students learn can help explain student propensities to choose a particular major and their preferences for a learning environment. As the availability of online courses continues to grow, educational institutions, faculty, and students need assurances that an online curriculum will meet expectations for quality education. Irrespective of the learning environment or delivery mechanism, students expect a quality education that is student-centered and designed to meet their needs.

Courses in the decision sciences have a unique position in that they are mostly taught in business school environments yet heavily rooted in engineering content. The literatures in engineering and management education draw attention to the importance of considering LSs in instructional strategies and learning activities. The complexity of considering engineering and management related LS implications as a means to understanding the learning-teaching style connection in the decision sciences is a rich and fertile avenue for future research.

We contend that it is important for faculty teaching distance education courses in the decision sciences to gain as much insight into the learning process as possible. Specifically we assert that faculty 1) become familiar with their LS, and 2) understand the style differences of their students, and 3) teach them their LS strengths and weaknesses. This information should then be used to make informed decisions about instructional approaches and learning activities that account for learning differences with the goal of achieving greater student retention, satisfaction and performance.



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## **EXPERIENCES WITH ASSURANCE OF LEARNING INTRODUCTION**

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### **ABSTRACT**

Assessment of learning is basic to curricular improvement. Establishing learning goals, evaluating student performance relative to these goals, and modifying curricula based on results of these assessments leads to strong academic programs. This study looks at assurance of learning programs at AACSB accredited schools.

### **INTRODUCTION**

AACSB – International, The Association to Advance Collegiate Schools of Business, is the premier accrediting body for schools of business in the world. As of September 2009, 570 member institutions hold AACSB business accreditation, of which 171 have additional specialized accreditation for their accounting programs. In total 33 countries represent the Accreditation Council, and 105 members are from outside the United States.

AACSB accreditation and maintenance of accreditation is based primarily on three areas:

1. Mission-based strategic planning
2. Assurance of Learning
3. Faculty sufficiency

All accredited business programs and those seeking accreditation must develop and be guided by mission-based strategic plans that have been structured using faculty input and that support the strategic mission of the institution as a whole. Accredited business programs must maintain a qualified faculty who is dedicated to the mission of the program. In addition, accredited business programs must develop an Assurance of Learning program (AOL) that helps them manage the curriculum designed to produce highly qualified graduates. This paper focuses on AOL programs and the experiences of accredited schools of business.

### **BACKGROUND**

As business programs work to enhance and improve curricula, assessing learning plays an important role in determining where programs should focus attention. Excerpts from the AACSB Standards document, *Eligibility Procedures and Accreditation Standards for Business Accreditation* [2], show the intent and importance of assurance of learning:

### **Intent of Assurance of Learning Standards**

Assurance of Learning Standards evaluate how well the school accomplishes the educational aims at the core of its activities. The learning process is separate from the demonstration that students achieve learning goals. Do students achieve learning appropriate to the programs in which they participate? Do they have the knowledge and skills appropriate to their earned degrees? Because of differences in mission, student population, employer population, and other circumstances, the program learning goals will differ from school to school. Every school should enunciate and measure its educational goals. Few characteristics of the school will be as important to stakeholders as knowing the accomplishment levels of the school's students when compared against the school's learning goals.

Assurance of learning to demonstrate accountability (such as in accreditation) is an important reason to assess learning accomplishments. Measures of learning can assure external constituents such as potential students, trustees, public officials, supporters, and accreditors, that the organization meets its goals.

Another important function for measures of learning is to assist the school and faculty members to improve programs and courses. By measuring learning the school can evaluate its students' success at achieving learning goals, can use the measures to plan improvement efforts, and (depending on the type of measures) can provide feedback and guidance for individual students.

To emphasize the importance of Assurance of Learning, four of the 21 Standards are dedicated to defining and measuring achievement of learning goals.

As an initial and critical step in its demonstration of learning, the school must develop a list of the learning goals for which it will demonstrate assurance of learning.

Learning goals serve two purposes. First, learning goals convey to participants, faculty and students, the educational outcomes toward which they are working. This helps in setting priorities and emphasis, designing learning experiences, and fulfilling educational expectations. While the learning goals cannot be exhaustively stated for any higher education program, it is possible to set educational targets and to assure that the learning is progressing in the specified direction. Second, educational goals assist potential students to choose programs that fit their personal career goals. Only with an accurate understanding of the learning goals will a potential student be able to make an informed choice about whether to join the program [2].

The Standards also give explicit examples of how the programs are to be administered.

An AACSB white paper issued in 2007 described development and use of AOL programs as required in the Standards [1]:

AACSB introduced the concept of “outcomes assessment” in its 1991 standards and developed more formal, mature, requirements in 2003. AACSB expects accredited institutions to formulate specific learning goals and conduct appropriate direct assessments of learning for purposes of improving curricula when deficiencies or opportunities for improvement are found. The AOL standards support two principles



which are the foundation of AACSB accreditation, accountability and continuous improvement. By measuring learning the school can evaluate its students' success at achieving learning goals, can use the measures to plan improvement efforts, and (depending on the type of measures) can provide feedback and guidance for individual students. The outcomes assessment process should include:

1. Definition of student learning goals and objectives
2. Alignment of curricula with the adopted goals
3. Identification of instruments and measures to assess learning
4. Collection, analyzing, and dissemination of assessment information
5. Using assessment information for continuous improvement including documentation that the assessment process is being carried out in a systematic, ongoing basis. (AACSB Assessment Resource Center, 2007)

Another form of the above steps can be stated as:

1. What will our students learn in our program? What are our expectations?
2. How will they learn it?
3. How will we know they have learned it or not?
4. What will we do if they have not learned it?

## **STUDY APPROACH AND PRELIMINARY RESULTS**

The study reported on here investigated AOL experiences of accredited schools. A survey of deans and other faculty members involved in the AOL process addressed the following questions:

- What is the overarching objective of your AOL program?
- What is your role in the AOL process at your school?
- How many goals do you have?
- Which areas are covered in these goals?
- How frequently are these goals assessed?
- What methods do you use to assess goals?
- What types of support does your school provide for AOL?
- How have faculty, students, staff, and administrators received AOL?
- Which goals have you found to show the weakest performance?
- What strategies have you employed to improve performance on these goals?

The pilot survey reported here was distributed among AACSB accredited school in South Carolina. Preliminary results indicate guarded support for the AOL process across participant groups. Universities indicated that they have between four and eight learning goals in their AOL programs. Communication, critical thinking, ethics, and globalization were the primary areas included in most AOL programs. All programs evaluate goals each semester. Some areas identified as needing improvement include writing, critical thinking, and discipline specific knowledge. Making modifications to courses was the strategy indicated most frequently for

improving student performance. Further research will ask all accredited schools to participate in the survey. The survey is listed in the appendix.

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## APPENDIX

### ASSURANCE OF LEARNING SURVEY

Assurance of Learning (A of L) is one of the three cornerstones for AACSB accreditation and maintenance of accreditation. All AACSB accredited programs have instituted a formal process for the assessment of student learning. The goal of this survey is to gain an insight into the assessment process at your institution. The survey questions are specifically designed to enquire about the administration of assessment process at your institution. The answers given in this questionnaire are completely confidential and will only be used for research purposes. None of the information given here will be sold or traded to a third party. Thank you for your participation.

1. For each of the objectives please indicate the level of importance in your program:

	Very Important				Not at all important
Assess student performance	1	2	3	4	5
Improve student performance	1	2	3	4	5
Improve curricula	1	2	3	4	5

2. Your role in the Assurance of Learning process at your school is as:

- Chair of the assessment committee
- Member of the assessment committee
- Faculty member assessing specific goals
- Assessment coordinator
- Other-(please list) \_\_\_\_\_

3. How many general learning goals are there for your undergraduate program? \_\_\_\_\_

4. How many general learning goals are there for your graduate program? \_\_\_\_\_

5. The areas covered in your learning goals are: (please check all that apply)

Communication       Critical thinking     Ethics                       Globalization

Leadership       Teamwork               Technology               other

6. The learning goals are assessed :

Each semester                       Each academic year  
 Once in two years                       Other:  
 \_\_\_\_\_

7. The assessment vehicles used at your institution are: (please check all that apply)

- Course embedded measures such as cases, exams, projects, assignments etc.
- Standardized tests such as ETS/MFT
- Senior exit exams
- Employer surveys
- Institutional effectiveness reports
- Student surveys
- Other-(please list)-----

8. The type/s of support provided for Assurance of Learning process at your institution is/are:

(please check all that apply)

- Financial - part of annual budget
- Release time for director
- Hired an assessment coordinator
- Administrative assistant dedicated time

9. Please describe the reception of the Assurance of Learning process at your institution by the following stakeholders:

	<b>Strong</b>	<b>Moderate</b>	<b>Weak</b>
<b>Faculty</b>			
Overall Embracement of AOL			
Support of the process			
Burdened by the process			
Opposition of the process			
Refusal to participate			



Action Research in a Business Classroom – Case Study of The Perfect Storm

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## Abstract

This research study looks at the implementation of an action research project within a blended learning human resource management class in employee and labor relations. The internal and external environment created conditions that converged in the Perfect Storm and resulted in an almost disastrous learning experience for faculty and students. What is critical about this project is that it could happen in even the most benign and calmest of waters. In an integrated system, the manipulation of one variable creates an impact on the other variables/systems within that environment. The failure to predict the impact and mitigate the damages can lead to disastrous results. The institution must be ready, at all levels, to implement and leverage technology to create distance-learning only environments for traditional students (and faculty) with a bias toward face-to-face educational experience.

Among the lofty goals of academe are the broadening of the students' intellectual and practice experience, increasing their content and business knowledge, sharpening their insight, honing skills, and preparing them to become contributing members of society. Some of the students were stellar performers who have successfully matriculated through K-12. Others were late bloomers or poor performers in high school who did not develop the study skills necessary to perform well at the collegiate level.

Consistent with the ever-changing economic landscape, the profession of education has navigated a series of tumultuous twists and turns as employers are expecting the end product (school of business graduates) to be able to contribute to the organization in meaningful ways and to bring fresh ideas and skills into the workplace. The 2007 SHRM Workforce Readiness study shows that both high school and college graduates have deficiencies when they enter the workplace (SHRM, 2007). For college graduates, the reported deficiencies are around critical and analytical thinking and communication skills (particularly oral skills). There is also a push among accrediting agencies to be able to assess the efficacy of one's treatment of "education" and to demonstrate that the school's mission and practices are consistent.

Among the ways posited to provide the best opportunity to accomplish the goals of academe is to provide cutting-edge technological training in conjunction with expert content expert instructional delivery, supported by appropriate assessment activities. The reported research study discusses an attempt to incorporate these factors into the learning experience of students in a single undergraduate course in employee and labor relations, a required course for students in the HR concentration and an elective course for students in the Certificate in HR Program.

Immediately prior to this action research project, there was a restructuring of distance learning, particularly with respect to who had ownership of the various pieces that directly affected faculty – that is, requirements for distance learning courses, support for faculty in terms of training of web-based tools, approval of distance learning courses, and feedback to faculty

concerning improvements to the courses. Before this restructuring, several different institutional entities were responsible for portions of these items, and faculty could receive approval in one area but have to deal with overlapping responsibilities/requirements from another area. Some faculty were able to create distance learning courses without adhering to any stated criteria, because department chairs controlled whether or not a course would be offered as a DL course.

It is within this institutional and economic context that this researcher undertook an action learning research project. Some might call what is about to be shared “The Perfect Storm” – I would call it the tsunami of the collision between educational intent and practice.

#### Research Question and Rationale

What is the appropriate mix/intervention of experiential learning, technology, and instructor-led teaching to provide a learning environment conducive to student success to transition faculty member from “Sage on the stage” to “Guide on the Side” when dealing with heterogeneous student population?

#### Literature Review

##### ***Argument for use of technology in the classroom.***

One of the purposes of web-based and technology-assisted courses is to provide an opportunity for students to engage with state-of-the-art technology, while concomitantly being able to schedule their learning experience(s) around their busy life schedule. This becomes increasingly important as both traditional and nontraditional students juggle work, family, community, and academic responsibilities. The literature on experiential learning has settled the case that there needs to be a good correspondence between the experiential activity (whether with technology or without it) that they are practicing and what is applicable in their world of work (Smith, 2003; Bassi, Benson & Cheney, 1997; Duley & Permaul, 1984; Knapper & Cropley, 1985; Lenz, 1985; Knowles, 1978; Kolb & Lewis, 1986; Burkhötter & Schaer, 1984-5; )



In addition, in order for their classroom experience to be meaningful, students must perceive a connection between what they do in the classroom and what is required of them in the other important realms of their lives. The implementation of technology facilitates the students' move from instructor-guided classroom learning to self-directed and self-motivated experience-based and life-long learning (Knapper & Cropley, 1985; Lenz, 1985; Knowles, 1978). Furthermore, Duley and Permaul (1984:20) found that "Students involved in experience-based learning also have improved attitudes toward learning in general. Students become more inquisitive, asking more substantive questions in class."

The acquisition and honing of technological skills is important for at least three reasons: (1) Technology provides access to a wealth of information; (2) real-world application is essential to develop critical thinkers and 21st century employees and entrepreneurs; (3) Students benefit from their ability to apply technology in real-world settings, to demonstrate competence (and even mastery) which makes them more competitive and valuable to the employer; and (4) Greater choice is afforded the individual who has both practical hands-on experience and the ability to marshal the experience and knowledge of others through technology.

Gagnon and Smith (2001:38-39) argue that experiential educational techniques, which may include computer-based or technologically oriented techniques could "enhance student learning attitudes, initiative, comprehension and retention; achieve higher levels of learning; offer business and other students the concrete learning experiences they prefer and which reinforce classroom principles; expose students to adult professionals and their problem-oriented focus; and challenge the students' social and communicative skills and ability for independent thinking and direction. From these encounters, the students' choice of careers, job prospects, and career advancements are also improved."

### Blended Learning

According to Garrison and Vaughn (2008), "Blended learning is the thoughtful fusion of face-to-face and on-line learning experience. Chickering and Garrison (1987) also suggest that

there are seven principles of good practice in undergraduate education. They are: (1) To encourage contacts between students and faculty; (2) Develop reciprocity and cooperation among students in the course; (3) Use active learning techniques such as case studies, discussion board, on-line assessments, project/workshop, and on-line blogging; (4) Give prompt feedback to the students (and this is increasingly important to millennial students; (5) Emphasize time on task – students want to know how long an assignment should take; (6) Communicate high expectations; and (7) Respect diverse talents and ways of learning.

Shibley (2009) identified ten ways in which a blended course design could be improved: Using learning goals and creating opportunities for pre-class and post-class learning and rehearsal; use of both on-line and face-to-face interactions along with multiple communication channels; employing grading strategies with low-value and high-value assignments; and both seeking assistance and staying organized.

#### Research Study.

Faculty member (hereafter referred to as “I”) participated in an Action Research Institute funded by the office responsible for faculty training in technology and teaching excellence. This training provided the rationale for action research and provided examples of blended learning that enhanced the learning environment for students in several different classes on campus. It also provided faculty with an opportunity to interact with each other, the facilitators, and the educational technology experts on campus. Faculty were given the opportunity to submit an action learning research proposal for funding, which would be implemented in Fall 2009 semester. The action learning proposal had to be approved by the department chair and dean. The faculty member had to prove they had either successfully completed or refreshed human subjects training and this attestation was accompanied by an application for IRB approval, signed by faculty member, department chair and acting dean. A 3-4 member committee reviewed the proposals and selected several for funding. This reported study was approved,

and I offered a plan for faculty interventions which required at some point that the two distance learning classes to have face-to-face interaction with me.

### Research Design, Methods, and Sample

The institution of interest is a Master's I institution in the southeastern United States, which is part of a 17-institution university system. The students are predominantly African-American, with a good mix between first and second generation college. There is a distance learning program, and within that program, there is an opportunity for distance learning courses created at this university to be part of the system-wide distance learning portal. The anticipated sample was of 30-35 non-traditional students and 15 traditional students enrolled in each of two distance learning classes. Actual sample was eight traditional students in a single DL class, since five of the six students in the second DL class were also in the first DL class. All students were between 20-24 years of age and had less than 3 months of career-level work experience (one student had had a three-month HR internship; the other students had part-time MacDonald's type counter type work). All eight students were African-American females who had only had one HR course prior to this course. Therefore, the integrated course interventions would be around individual student maturity and technology readiness levels versus cross-generation differences.

The focus on undergraduate learning included practices identified by Chickering and Gamson (2008). To incorporate these principles into the reported distance learning course, the following course components were included: (1) I contacted students prior to the course and communicated general information on own identity and interests and contact information, how the course fit into the overall HR program, the books that would be used, and the integration of technology with face-to-face interactions. (2) Students were told that we would use discussion board and that they would be assigned to small groups to facilitate deeper discussions of content. In addition, the students were asked to create a webpage and to engage in Water cooler discussions to enable them to build community. Questions in Water cooler related to

self-disclosures and personal statements (their 30-second message to introduce themselves to others). (3) Active learning techniques such as case studies, discussion board, on-line assessments, project/workshop, and on-line blogging. (4) Feedback for the course was included through on-line quizzes created by the publisher which scored the quizzes immediately; verbal feedback in face-to-face class – that was a great answer; I like where you’re going, but you’re a little off track; and the use of follow-up questions. I also summarized discussions to ensure that students knew what the “correct” answer was, if there was only one correct answer. I also responded in Discussion Board to ensure that the students remained on track through their on-line discussions. (5) Time on task was more difficult to incorporate. The exercise/homework/cases workbook gave them a projected time that each activity should take. I required them to access Blackboard discussion board at least four times a week on three different days, responding to my question and the responses of their fellow students. I also included the number of hits that each Blackboard component had. (6) In my initial e-mail as well as in my orientation for the students, I emphasized my high expectations for them and their expectations for themselves. When providing them with feedback, I re-emphasized my belief that they were intelligent, articulate, and unique individuals whose answers needed some minor tweaking. (7) Finally, the purpose of this reported study is to discuss the ways in which diverse talents and ways of learning were respected and accommodated.

Shibley’s (2009) suggestions for improving blended learning classes were incorporated when I ensured that detailed learning goals were provided to the students, both in the context of the course and in the context of the overall HR Program. Students were given exercises and activities in which to engage or about which to think before each scheduled class section. A discussion board was provided to get students to begin thinking about the material and a case study or exercise was also assigned to force them to read the text prior to the scheduled face-to-face meetings. The higher-level graded work was given to students to grapple with the content after they had had an instructor-led treatment of it to supplement what their thoughts

were from the text, supplemental readings, introduction exercises and activities, and discussion boards. We scheduled face-to-face meetings as well as on-line activities to encourage student engagement and interaction. Multiple forms of communication included use of e-mails, announcements in Blackboard, handouts, face-to-face communication, and telephones. Students had assignments that they had to download from Blackboard or other links that I provided, videotapes through You-Tube and other media resources, as well as the national SHRM website and its links. A section on electronic links was provided in the resources section of their Blackboard course. Students rarely called to have their issues resolved in real time but relied on electronic communications or our face-to-face meetings. However, if students saw me on campus, they were likely to ask me questions related to the class. Because of the challenges we had throughout the semester and the use of multiple methods of communication, there were many opportunities for the proverbial ball to be dropped. Digital dropbox was not the preferred vehicle for turning in homework for the students, and they often duplicated their efforts by having back-up plans – they would “try” digital dropbox, then send the homework assignments to my home business and university e-mail accounts.

### Action Learning

“Action learning is both a process and a powerful program that involves a small group of people solving real problems while at the same time focusing on what they are learning and how their learning can benefit each group member and the organization as a whole” (Marquardt 1999:4). In this case, action learning is taking what happens in the internal and external environment, through observation, experience and feedback and making adjustments in the course to facilitate a better learning experience for the students. Typically, the six steps in action learning are: Problem Identification, Planning, Action, Observation, Reflection, and Implications for Practice.

## Problem Identification

The purposes of this action learning project are fourfold: (1) To ascertain how and to what extent one would use technology to enhance learning and the viability of distance education for students at the institution of interest. (2) To utilize sound educational theory around pedagogy versus adult learning theory (andragogy) in practice. That is, how does one utilize the tenets of these theories in leveraging instruction for a heterogeneous class with traditional on-campus students with concentration in field, distance learning students who access course through UNC Distance Learning Portal, and distance learning working professionals enrolled in a certificate program? The traditional on-campus students are required to take this course as part of the HR Concentration. Currently, the Management major is not offered as a distance learning program; therefore, the HR concentration should not be offered as a distance learning program. The working professionals have this course as one of several selections among which they might choose four out of six courses for their Certificate Program. The course is also available to other business and non-business students as an elective if they have met three pre-requisites, whether seeking to earn a minor or taking for their own edification. (3) To determine if there is a need for differentiated instruction; and, if so, what are the most effective tools and practices, and what levels of support are available for the faculty meeting; and (4) To capture the experiential learning of the students and faculty members as adjustments are made to the class based on JIT instructional delivery, feedback, and assessments.

## Planning

The Action Research Institute and Proposal Review were described earlier.

## Action, Observation, Reflection, and Implications for Practice

### *Institutional Miscues and Snafus – Storm Clouds are Gathering*

- ▶ Course scheduling – one of the courses part of this action learning project was not available during pre-registration.

- ▶ On-line course in which only traditional students were enrolled had been developed as part of a grant for working professionals
- ▶ Inability to get classroom space – Department chair refused to assign a classroom for the “on-line” course which had only on-campus students in the course
- ▶ System changes and department chair access as “instructor” in all Blackboard courses
- ▶ Technology Challenges – Wrong course copied/created by IR; Blackboard filecopy protocol breakdown; limited capacity
- ▶ Disconnect between Office of Distance Learning and academic departments
- ▶ Deficient Pre-requisite course – junior faculty had incorrect course description and created “own” course with own, rather than program, learning objectives.

The primary text for compensation did not have the “bells and whistles”, clipart, “sexy” pages to which undergraduate students tend to gravitate. It also did not provide the on-line support that traditional students need. We were under an institutional mandate to ensure that all texts were ordered by early April, so that discounted texts could be found. Because the texts could not be ordered before the classes were actually included in Banner, this created another complication. Five of the six students in the compensation and benefits course were also in the employee and labor relations course. All of the students were African-American women except the one student only in the Compensation and Benefits course who is an Asian female with some difficulty speaking and understanding English. The undergraduate students in the traditional course were HR Concentration students who will be required to take the national certification exam in Human Resources to complete their program. The students in the Certificate Program did not have that as a requirement and would not be allowed to take the capstone class in HR.

### *Student Challenges*

The students in this course experienced a number of additional challenges:

- ▶ Based on a self-reported assessment, they were traditional students with strong need and desire for face-to-face learning.

- ▶ Although there were labs on campus, they did not allow sound and students were limited to the amount of time they could spend on the computers. Therefore, they had limited computer access, and only 2 of the 8 students had own computers.
- ▶ Faculty member's office was located off campus, and no shuttle service was available to transport the students to that site, even if allowed to meet with her.
- ▶ Differential Advisement – who's in course – An administrative assistant was providing advisement assistance and mis-directed students either "in" or "out" of the required course.
- ▶ Students had a clear preference for multiple choice exams and were not receptive to short-answer, discussion question exams which required integration, synthesis, and critical thinking.
- ▶ The students had constantly full e-mail boxes; several students were kicked out of tests as they were completing them and could not re-enter the tests.
- ▶ The students' learning styles were inconsistent with DL course with no face-to-face component.
- ▶ The students had a strong desire for HR career and needed face-to-face interaction with faculty member to learn more about field, hear stories, examples, and be mentored.
- ▶ The students, as a group, did not have foundational text, since the faculty members teaching the pre-requisite changed the text and did not utilize the integrative text.

### *Challenge, Reflection and Change*

1. Student need for face-to-face interaction and mentoring (African-American students are relational)
2. Student expressed concerns about having discussion-based tests.
3. Students performed poorly on the first, discussion-question based test.
4. Incorrect course descriptions for pre-requisite were given to the students, and 40% of the course content was not covered.



5. Full e-mailboxes. Student Problems with digital dropbox (DDB). Multiple locations of work for faculty member to track and grade
6. Could not use sound clips in library without headphones
7. Students with test-taking anxiety
8. Students felt syllabus was too detailed and wanted weekly reminded re homework, etc.
9. Students' lack of familiarity with discussion board as community learning and concern about number of times having to access discussion board
10. Incorporation of technology into student work – requested assistance from technology group but request was declined

*Faculty Member's Adjustments (Adjustments match issue related above)*

1. Held informal meetings (tutorials) without grades being allocated for attendance
2. Held tutorial to review for Test 1
3. Offered re-test with grades averaged or correct test for extra points
4. Covered foundational material that should have been covered previously (3 weeks of instructional time)
5. Provided home e-mail address or preferred e-mail address outside of Blackboard.  
Accepted work outside of DDB.
6. Videoclips became supplemental versus required material
7. Coached students through test during test
8. Declined to make adjustment; reviewed syllabus and course design with students
9. Sent reminder e-mails concerning Discussion Board AND conducted tutorial on discussion board as interactive discussion among learning community, not Q&A.  
Changed # of times on Discussion board. Used announcement to remind of major (project) assignments
10. Changed student assignment from more up-to-date technology and encouraged them to be creative in going beyond their comfort zone

### Key Learnings from this Experience.

With any organization change, a number of components must be in place before the change is instituted. In this case there was a lack of institutional readiness for technology. While parts of the infrastructure are in place, many pieces are needed. There are too many moving parts in the current environment, including the hiring of a new provost effective July 1, 2009, with her own ideas and perspectives; budget crisis which resulted in larger class sizes and fewer support staff. Both the school of business and the overall institution were undergoing preparation for Spring 2010 SACs and AACSB-IME re-accreditation visits.

Faculty are taught content relevant to their area during doctoral programs, but pedagogy and adult-centered learning are not part of what they learn. Faculty typically teach as they were taught. I had two courses that focused on adult learning theory and pedagogy. I have participated in a number of workshops and training opportunities at university and elsewhere and felt comfortable as an educator. When dealing with an administrator who did not understand pilot testing, norm groups, pedagogy or adult learning theory who made decisions which negatively impacted my courses (and ultimately my teaching evaluations), I found myself locked into a negative mode.

All content is not equally viable for distance learning treatment. The blended learning model was an ideal compromise between faculty-led and student-centered learning. When technology works well, it is a great complement. When it does not, as it did not in this case study, it is a huge disaster. With all of the institutional elements not in place, the unwillingness of administration to make adjustments to meet student needs, lack of leadership in ensuring that junior faculty taught the required content and were held accountable regarding textbook changes, etc., this initiative was doomed for failure.

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## **Assessment of Technology Skills in Core Business Classes**

### **Panel Moderator:**

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### **Panelists:**

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One of the major requirements for accreditation agencies including American Assembly of Collegiate Schools of Business (AACSB) and ABET accreditation is that a school demonstrate that there is a process in place for the continuous evaluation of the programs. For each course within each program, a faculty member is required to define learning objectives or outcomes, describe methods for measuring how well those objectives are achieved, and indicate how the results are used to improve the course and eventually the program. This process is referred to as Assurance of Learning (AOL) by AACSB and assessment and continuous improvement in ABET. This panel focuses on how technology skills (such as Excel, database, programming, etc.) can be assessed at the course level. The panelists will discuss issues regarding this type of assessment and seek audience perspectives on how best to do this successfully.

The panel will discuss the following topics:

1. Course level assessment of technology skills in an IT program
2. Course level assessment of the use of Excel in business statistics and quantitative methods courses.
3. Tools for the assessment of general competency levels prior to enrollment in a class.

There are two primary reasons for assessing technology competency - to satisfy accreditation requirements and to assess if students possess prerequisite knowledge of technology for a class. The prevalent use of technology throughout the business curriculum has necessitated the need to develop tools to assess the technology skills of students completing these courses.

One of the panelists will describe the assessment process designed and implemented for an undergraduate program in information technology (IT) with specific emphasis on course-level assessment of technology skills and discuss how the course-level assessment data can be used in the ABET accreditation process. Examples of course-level assessment instruments used in the program will be provided.

Two of the panelists are in business schools where Microsoft Excel is used in statistics and quantitative methods courses. The course objectives for these core courses are of the form:

- Business Statistics: Students use spreadsheet software to summarize sets of data.
- Quantitative Analysis: Students use spreadsheet software to solve and evaluate linear regression, linear programming and / or forecasting models.

One must be careful to separate the assessment of the use of technology from the mastery of course content. It is also important that the assessment of the use of technology not interfere with the learning of course content. Some other issues that need to be addressed prior to assessing Excel skills in these required (and, often) multi-section core classes are:

- What is the skill set to be tested in each of these courses? Is it going to be the same skill set each semester?
- If projects are not going to be common (either across sections or drawn from a common bank), what is the mechanism to ensure that the different projects are testing the same skill set?
- If the projects are going to be common, who creates them? How much variation should there be among the projects in a given semester? Between semesters?
- How should the reporting procedure be streamlined to facilitate the compilation of this information?

The assessment of the general level of technological competency a student possesses entering the business school is equally important so that faculty members do not have to spend time teaching the application rather than the use of the application. To help determine competency, many schools evaluate technology skills using on-line training and assessment packages. There are several commercial products available as well as some developed “in-house”. These products can be used in various ways:

- To test-out or verify competency level prior to enrolling in a course;
- To incorporate training and assessment into courses; or
- As an on-line resource for those who need to “catch-up” on their skills.

An overview will be presented of products publishers make available to higher education for technology instruction and assessment. The challenge is finding a product that truly measures knowledge in a single setting and at a reasonable cost. Another factor is if the product will provide adequate remediation if the student does not possess desired requisite knowledge.

Employers of business school graduates expect a level of proficiency in technology and properly conducted assessment helps schools meet the employers’ expectations.

**Class Preparation: Traditional Vs. Online**  
**SEDSI 2010 Workshop Proposed by four Georgia WebMBA Faculty:**

Dr. Robin Cheramie (Kennesaw State University)  
Dr. Jan Flynn (Georgia College and State University)  
Dr. Barbara Price (Georgia State University)  
Dr. Brad Prince (University of West Georgia)

Abstract:

Four faculty who currently teach in the Georgia WebMBA program will present this panel outlining traditional and online class preparation. The four presenters have different levels of experience teaching online and therefore will bring a unique perspective to the table. Topics will include basic differences, similarities, advantages, and disadvantages, Classroom Management Systems, and a variety of personal experiences gained from developing course content for both methods of course delivery.

**Robin Cheramie (Kennesaw State University): Basic differences, similarities, advantages, and disadvantages.**

My advice for developing a new online prep would be to use a traditional course as the basic template and try to re-create as many assignments as possible to the online format. I teach Organizational behavior which requires much class discussion, case analyses, and heavy participation from students for a class to be successful. I had been teaching Organizational Behavior for many years in the traditional format and had developed many group exercises and individual exercises to aid in class discussions. Thus, when I developed my first online class, I was very concerned that I would miss these “quality” discussions in the transition. What I have discovered is that by transferring much of my material to the online format, I have improved the quality of both classes. For instance, you can still require the same amount of reading (book chapters, Harvard Business Review cases/articles, etc.) but you must develop better questions to guide the discussions towards the class concepts. In traditional courses, I would just let the class comments guide my questions or the nonverbal cues of “lost” looks to help me refine my questions in each class. However, in an online class, I don’t have the luxury of reading these cues and I must develop more thought-provoking questions upfront to create quality discussions.

Similarities/Differences: For my course, there are many similarities between the two classes. For instance, both formats require students to participate in weekly case discussions, participate in-group activities, take essay exams, and complete both individual and group assignments. The main difference between the two courses is the asynchronous timeline and participation of students. Students have a 7-10 day window to complete these assignments and may take a few days to respond to someone else’s comments. With an online class, you need to be a little more flexible with deadlines than a face-to-face class.

Advantages/Disadvantages: I have been most impressed by the quality of case discussions within my online class. A major advantage for the online course is that students have time to craft a thought-provoking quality response to a case or response to another student; whereas, traditional classrooms may not provoke such critical thinking. A disadvantage to an online environment is the feeling of being “on-call” for most of the workweek. Of course, we can set student expectations for available times, but I believe students expect quick responses to questions. It is lonely teaching in this environment (and students feel alone as well). My philosophy is to provide quick feedback and to help them feel comfortable in this unique environment. Unfortunately, students may misinterpret written communications and get very frustrated if they have to wait for any type of response.



## **Jan Flynn (Georgia College and State University): What I Wish They'd Told Me**

I've just completed teaching my first online course. It's one of those things in life that seems like a good idea at the time, but once you get into it, you look at yourself and ask "what WAS I thinking." It looks very different from the inside than from the outside. I went into the process blind. I was asked if I would do it, and I said "yes". What I walked into was a trial by fire. I learned a lot very quickly as I set out to develop the course. I learned even more from my students as I struggled to stay on top of things throughout the semester. I'm now a convert. I actually like the online process and look forward to continuing to work in this format.

As hindsight is 20/20, here's what I would say to anyone starting out in this new endeavor...what I wish someone had told me.

- It's a lot more work than you think it's going to be. Be prepared to spend time.
- 90% of the course success is in course development...if it's well-structured, it will go well.
- Don't try to take a traditional course format and "translate" it to online work. It won't work. This is "greenfield" work...from the ground up.
- Find a good model and stick to it. ORPA works VERY well...Overview/Resources/Practice/Assessment.
- Keep a student perspective to everything you do..."what is the student going to see, think, react to, question, etc. when they see this information?"
- Be mindful of the size of the files you build. (I built these great narrated PowerPoint slides that were way too large for the system to handle.)
- Make friends with a tech person! You'll need them somewhere along the way.
- Be prepared for whining because you'll have students who play it to the max.
- Be prepared for "pot shots." Some students will always see it as your fault.
- Be explicit in your instructions. If you don't say "no notes, no text, no nothing", they'll assume they can use what they please during the test.
- Don't react to email messages. Take your time and respond thoughtfully after you settle down and let the emotion go.
- You'll NEVER respond quickly enough to suit students, so don't let it get to you.
- Building relationships with individual students is a infinitely more difficult than in a traditional setting, but it is critical to success.
- Learn to use SKYPE. It's a great program to let you build relationships with your students.
- Set your standards high and stick to them....(yes spelling does count when you do your papers!)
- Always be mindful that our students work full-time so Sunday night due dates are appreciated.

## **Brad Prince (University of West Georgia): Classroom Management Systems**

Once a faculty member has prepared online content, the next step is to deal with the Classroom Management System (CMS). Many of us use Blackboard or WebCT, and just when you get comfortable with one system your university changes to something new. While there are many nice features, it is worth considering which elements you should use and which ones you should stay away from. Also, there are many tools available within the CMS that are available in some form or another from outside “free” service providers.

For faculty just beginning to teach online, it is beneficial to hear a discussion of a few of the tools available within the CMS, when they are the most helpful, and when to consider some third party provider. Below is a list of a few of these considerations.

1. CMS chat vs. Google, Skype, and other chat tools. Many CMSs have some version of “who’s online” or chat available. These tools are helpful because when you sign in it shows to all students in all classes that you are available. However, you have to sign in to the CMS to be able to chat with students. Google, Skype, and other chat or instant message tools can be automatically logged in, available to only certain people, and provide easier use of voice and video sharing.
2. CMS discussion boards vs. blogs and wikis. Discussion boards are nice because they provide an asynchronous means of communication. However, again you must log into the system to keep up with communication. If you ever had multiple sections of the same course you have to update it on all three. Blogs and wikis are third-party products that can be linked within the CMS and provide an easier way to update information across sections. However, if students respond they will need another username and password.
3. CMS video content vs. YouTube and Screencast. Many professors are moving toward online video content for course material distribution. Should they use the file system within the CMS or a public option such as YouTube or Screencast? One is more secure, while the other is easier to manage. Which is right?

## **Barbara Price (Georgia Southern): Converting from Online to Traditional**

Over the past five years, I have begun to teach undergraduate statistics and quantitative analysis courses online as well as face-to-face (traditional). In all cases, the text and course objectives have been identical for the face-to-face and the online version of a course. So, naively I thought that the preparation would be the same. That is, I could take a traditional course and simply put it online. Well, I found it was not quite that easy.

Moving a course to online requires more extensive preparation and preplanning. For example, instead of making an outline and lecturing in class using examples and hands-on exercises (which I can do quickly in these courses I have taught for years) I needed to type notes and include explanations of the procedures and steps for solution. Then, I found that these were not as clear as they were with audio, so I created mini voice over presentations to walk students through examples. Also, recommended problems were used but now I needed to post solutions for the students to compare their work. Finally, I found that it helped to have a guide for each module to walk the class through the best route for learning the material. Finally, tests needed to be created that assessed learning and discouraged collaboration. Since the courses I teach are focused on the process, not just the answer, grading was intense and one-on-one feedback took time. That is, I couldn't just grade the tests and rely on going over it in class one time! Finally, I found the need to have more frequent assessments in order to monitor progress before it was too late. I could not rely on eye contact.

So, how about moving in the other direction? I am in the process of doing that this semester. I was asked to offer a course I have taught in the WebMBA and prepped with a new text last spring, to a large (46 student) face-to-face MBA class this fall. Since I had the course prepped and tested for online delivery, I thought it would be a simple transition. I have found that although the skeleton exists, I need to regroup to develop presentations for a two-and-a-half hour once a week class. That is, the students are not "learning on their own, at their own pace" but are coming to class for traditional lecture, discussion, and hands-on lab environment work. Thus, I need to prepare and then be able to deliver on my feet. Is it possible that the clients are different?

Next semester, I will teach two sections of the course online and one face-to-face. It will be interesting to see if they tend to move closer together not just in content but in coverage. That is, it might be interesting to tape some portions of the face-to-face and offer it to the online group as a supplement. I am already offering many of the online materials to the face-to-face group to supplement the text and class work.

# **A Demonstration of a Multi-User Database System to Report Student Academic Difficulty, Improve Student Progress, and Retention**

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## Abstract

Improving student academic achievement and retention rates requires a proactive approach that identifies student academic difficulty early. Instructors are on the front lines of the battle to improve student academic achievement, since they interact with students in courses and assess their achievement throughout the semester. Furthermore, instructors are often the first to realize that students come to the classroom with a variety of problems and issues that lead to negative behavior or to poor academic performance. Unfortunately, faculty members are often not qualified to deal with some of these problems or simply prefer not to. Counselors and academic advisors are trained and more prepared to address this problem. If these professionals are not qualified or prepared to assist these students, they can refer them to more qualified specialist that can ensure students receive the counseling and help they need.

In order for effective intervention to take place, student academic difficulties and other issues need to be reported to counselors and advisors early enough in the course. Also, a mechanism is needed to determine if students are having the same problems in other courses and if they had similar problems in past semesters. Addressing student academic difficulty through early reporting and intervention techniques requires the use of an aggregate system that connects instructors' observations while students are taking courses with different instructors throughout campus. Therefore, an automated multi-user database system is needed to aggregate these observations and track their corrective action, while intervention techniques are implemented to assist students. This automated approach should help improve student progress and retention rates since student learning obstacles are identified early, allowing counselors and advisors to take corrective action before students drop courses, withdraw from school, or end up doing poorly in their courses.

In order to address this problem, a centralized multi-user database system was developed and deployed in a community college in North Carolina that allows instructors to report student academic problems and issues that are affecting student success. This early reporting system allows advisors and counselors to intervene early enough to make a difference in students' success. Since the data submitted by instructors is stored in a centralized and secure database, it allows advisors and counselors to address students' problems and to initiate intervention techniques, because they know of the difficulties students are having in all of their courses.

Since instructors' submissions cannot be viewed by other instructors, students' privacy concerns are addressed. Furthermore, since data for a given student is maintained in a centralized database from semester to semester, counselors and advisors can gain a better understanding of all of the difficulties and issues a student has had in the past.

This presentation will demonstrate the use and features of this database system and discuss the possible development of similar systems that can be used to improve student progress and retention rates. Attendees will learn how Microsoft Access can be used to quickly develop a centralized database of student academic difficulties and other barriers to learning. Furthermore, they will also learn how this approach may lead to improvements in student progress and retention. Attendees will also learn how to use Microsoft Access to allow multiple users to access the same set of data on a local area network, how to search for data patterns and trends in student difficulties, and how to generate reports that can help address problem areas that are affecting many students.

**Key Words:** Early Reporting of Academic Difficulties, Database, Improving Retention

**Summary for Conference Program:**

Instructors' early reporting of student academic difficulty issues using a centralized database system allows rapid reporting and aggregate management of student academic progress and tracking of intervention techniques. A database system was developed and is currently in use at a community college in North Carolina that allows early reporting and management of student academic difficulties. This multi-user system is expected to improve student retention and academic progress.

**Suggested Track:** Teaching & Pedagogy