

Proceedings

**Southeast Decision Sciences Institute
Annual Meeting 2016
Colonial Williamsburg, VA**

February 17th-19th, 2016



SOUTHEAST DECISION SCIENCES INSTITUTE
ANNUAL MEETING
February 17-19, 2016

PROGRAM

Welcome to the Southeast Decision Sciences Institute Conference

On behalf of the council, officers, and 2016 program committee, I would like to welcome you to the 46th Annual Meeting of the Southeast Decision Sciences Institute (SEDSI) in Colonial Williamsburg, VA. The program committee has put together an excellent conference with almost 100 papers, panels and workshops that I think you will find to be enlightening and enjoyable. In addition to participating in some great sessions, I hope that this meeting will also provide you an opportunity to renew old friendships and to meet new colleagues from universities, businesses, and other organizations throughout the southeast and beyond. We are very fortunate this year to have one of the nation's leading case publishers and statistics software vendors participating in the sessions and exhibiting their products in the exhibition area. Please stop by to thank them for their support of our meeting and to see what they have to offer.

I would like to express my sincere gratitude to all of those who helped make this conference possible. It was truly a team effort. Many key individuals worked hard to help develop this conference and program for all of us to enjoy. They include a wonderful team of track chairs, reviewers, session chairs, special session developers, and graduate and undergraduate student paper judges. Also included are the officers and council members, both current and past, who were there to offer friendly advice, encouragement, and support throughout the process. I am very grateful to them for offering to share their knowledge and support.

This year we contracted with a new conference management system, Ex Ordo, and I appreciate their good customer support team for answering my dozens of questions as we explored how to navigate the system and put the program together.

I would also like to thank all of those at Presbyterian College for their encouragement over PC's role in conference over the past year. A special thank you goes to several individuals starting with Don Raber, Provost at Presbyterian College, who supported this endeavor. My Business Administration colleague Tobin Turner took the lead in reviewing papers for awards and stepped in to fill in quite a number of gaps. PC student intern Lauren Mahon brought her computer expertise, patience, and organizational skills to help complete registration. Lastly, my family has graciously tolerated my late evenings and Saturdays at the office, my messy piles at home, and weeks of take-out food. I am grateful for you all.

My final expression of gratitude goes to you, the participants and members of SEDSI. The purpose of this conference is to serve you, and it is because of you that this conference continues to be a success and continues to grow. I hope that you enjoy your time in Colonial Williamsburg and have a great conference.

Suzanne J. Smith, PhD
2016 SE DSI Program Chair

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The Decision Sciences Institute is a professional society dedicated to the development and application of quantitative and behavioral methods to administrative problems. Membership includes representatives from most of the functional areas of business. Through its journals, *Decision Sciences* and the *Decision Sciences Journal of Innovative Education*, along with national, international, and regional meetings, and other activities, the Decision Sciences Institute serves as a vehicle to advance and disseminate the theory, application, pedagogy, and curriculum development of the decision sciences.

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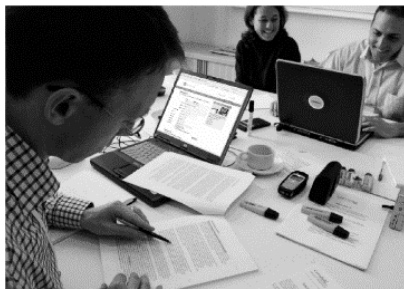
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Value-Added Pricing of Malted Grains for Craft Brewers

Forrest Stegelin, Dept. of Agricultural and Applied Economics, University of Georgia,
Athens, GA 30602-7509, stegelin@uga.edu

Abstract

What is the value or worth of an ingredient in a final product? McDonald's has its special sauce for the Big Mac; does that special sauce add value as adding to the price of the hamburger, and if so, how much? There are numerous other products that rely on a special ingredient to differentiate one from another. Should the source of the ingredient be rewarded with a higher price because of the uniqueness, and if so, what should that price be? The increasing numbers of craft brewers rely on special flavors in hops and malts to make their craft beers unique to the palate of its consumers. Home brewing is also very popular, whereby pre-packaged malts are purchased on-line. The use of malted grains (barley, wheat, oats) requires unique product quality specifications of the grain produced by farmers, and complex malting process, so what is the value-added price for the malted grain ingredient? Different strategies and models are employed to answer this question.

Background

Product or quality differentiation of a food product or beverage from similar basic foods or beverages is frequently accomplished through adding a "special" ingredient. It might be the special sauce of a McDonald's Big Mac or it might be just a basic seasoning or flavoring that adds kick or a unique flavor to a basic food product or condiment or it can be a malted grain that gives a craft beer a unique taste. For many consumer ready foods and beverages, however, it is this ingredient that establishes the value (or added-value) in the final product. Marketing ingredients are an element of the topic of food supply chain management (Pullman and Wu, 2012). So what is this ingredient worth toward the value of the final product? What is the price that the provider or source should receive for this ingredient, or what should the buyer pay for this ingredient? These questions arise from two different perspectives, and most likely have two different solutions.

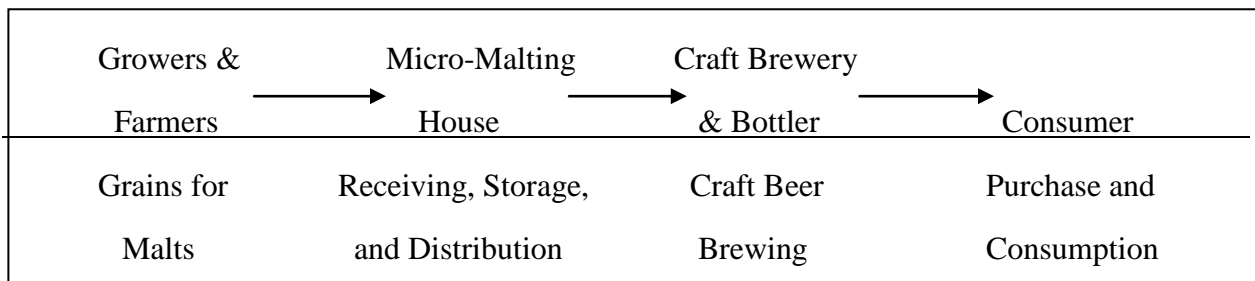


Figure 1. Typical supply chain for malted grains and craft beers.

An example for discussion is the choice by a craft beer brewer and bottler in selecting locally-grown hops or malts to be used in the brewing process. The reverse engineering of a price for the input was the question posed by a start-up micro-malting house sourcing locally produced grain malts for local or regional craft brewers – what price would be fair that reflects the quality and value-added benefits of specialty malts in consumer demand for a craft beer?

Malting grain is a specialized field requiring a great deal of expertise, space and unique equipment; consequently, most craft brewers purchase and use commercially malted grains.

Malting Process

Before addressing the pricing issue, a brief review of the malting phase of the craft beer brewing process as well as background on the craft beer craze may be helpful. Nearly thirty micro-malting houses in the US market specific base malts for the roughly 3,000 craft breweries, not counting the thousands of home brewers who purchase pre-packaged malts, mostly online. In the Southeastern US, only three micro-malting houses, located in North Carolina and Kentucky, served 142 craft breweries (micro, regional, brewpub, and contract brewers) in the six states of Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina in 2014. For a local start-up micro-malting house, the initial question typically is what types of base and/or specialty malts can be produced in sufficient quantities to meet the needs of the buying craft brewers – the supply side. The competitive advantage for the malt producer is found in providing (1) a unique enzymatic action, or (2) a unique protein content, or (3) a unique spicy flavor to the final product of the brewery – this becomes their selling value proposition. The malting business seeks to receive a premium, or value-added price for these malts, using ingredient branding. The buyer (craft brewer) has goals of either input cost minimization to make desired profits (margins), as discussed earlier in buyer pricing decisions, or developing a rationale for charging a higher price for the final product that reflects quality and value added benefits of specialty malts in consumer demand (and justifies paying a higher price for the ingredient). The task of reconciling these differences between seller and buyer is critical, especially for the local start-up micro-malting house trying to add value to the malt ingredient and establish a valued reputation in the industry.

To address the pricing question, a feasibility study (more of a marketing and demand analysis) was undertaken for a family-owned business whose owners were interested in establishing a micro-malting house in Georgia (Shepherd, 2014). The family members were well aware of the improbabilities and impossibilities of sourcing Georgia-grown hops; malted barley, including adjunct grains of oats, rye or wheat to complement the barley, was a distinct possibility. A demand analysis acknowledged sufficient potential demand for malt produced by a small micro-malt house producing 50+ tons of malt per year for the craft breweries having a total malt demand of about ten million pounds (5,000 tons) annually. A 1,000-barrel (31,000 gallon) brewery will use 70,000 pounds of malt a year. This potential demand, however, does not guarantee sales to a micro-malt house or a craft brewery.

In order for the micro-malting house to be profitable, it will need to obtain market share of sales to the 28 craft breweries in Georgia. This can be accomplished by producing consistently superior malted grains at premium, yet attractive prices – potentially the largest obstacle to overcome. The larger, more established malting companies (Malteurop North America, Inc, which included the former Archer Daniels Midland's malting division, and Cargill, Inc. are the two largest malt producers in the US; other large industry players include Rahr Malting, Briess Industries, and ABInbev) can charge lower prices due to their economies of scale. As a result, the micro-malting houses must focus on consistent quality and their ability to provide differentiated products as specified by their customers.

In understanding the malting process, for the end brewery products to be consistent, the maltsters must use consistent inputs, meaning the grains used must meet stringent specifications (requiring strict compliance by Georgia grain farmers as to variety and production and harvesting practices, particularly for barley) and the firm must decide how to obtain consistently high quality water. Environmental conditions can have significant impacts on the quality levels and prices of the inputs used in the manufacturing process, requiring the brewery to decide how to mitigate the risks. Water usage and subsequent disposal of the water and the malted grain byproducts could be of concern for the craft brewery.

The malting process encourages the grain to begin germinating with the process stopped by quickly drying the grain. After going through the malting process, much of the grain will undergo additional processing, like roasting, toasting, smoking, etc. to get a sweet and unique flavor desired in the beer. This creates a vast variety of grains with varying characteristics. During the brewing process, hops can be added early in the brewing cycle to provide bitterness to offset the sweetness of the malt and to serve as a preservative. Hops added later in the cycle will impart additional flavors and aromas; hops added after fermentation (dry hopping) produce bolder flavors and aromas. In the malting process, two quality measures are important: (a) grain quality parameters and (b) malt quality parameters. The three most important malt quality parameters are (1) malt extract (amount of fermentable sugars for alcohol), (2) diastatic power (amount of diastatic enzymes converting grain starch into soluble sugars), and (3) wort viscosity (thickness of wort relative to water, measuring the amount of stress a plant has undergone during grain filling). Brewers specify which malting barley varieties they will use based on their individual manufacturing process and product lines (year-round and seasonal beers). 2-row barley is replacing 6-row barley, which is being eliminated due to changes in the barley market. In order to meet brewers' specifications, malting barley varieties must be germinated uniformly and quickly to avoid mold growth and malt modification. Plump barley kernels contain higher levels of starch and smaller amounts of husk which results in higher extract yields. Blending malting barley lots to meet protein or other quality specifications can impact processing. Malting barley should also be stored at less than 13-percent moisture with good air circulation; otherwise, hot spots can cause heat damage and mold problems. Test weights for each lot must be less than 48 pounds per bushel.

Pricing Strategies for Malts

Numerous pricing strategies and formulas are understood and utilized in the food supply chain; however, most are addressing the target pricing question from the buyer's and final product manufacturer's decision making in reaching its profit goal or a desired profit (or desired profit margin) for the consumer good upon selling the item to the consumer or end-user. Most food or beverage purveyors are adept at solving this economic problem when there is only one variable input for producing a final product – marginal revenue equals marginal cost; the issue becomes much more complicated when multiple variable inputs (ingredients, in this discussion) are involved.

Because the pricing rules for each ingredient and for the processed products all depend on each other (proportions, prices, sources, etc.), every time an ingredient is purchased, selling prices for the final product should be updated. With current computer technology, software and spreadsheets, the final price can be updated instantaneously; however, a rational marketer would not be changing selling prices constantly to reflect the input price changes. The knowledge

would be there, nonetheless. The food or beverage manufacturer can use the pricing rules three-fold: (1) as a buying decision between competing ingredients, and (2) as a pricing decision to maintain desired profit margins, and (3) as an operation decision to decide which products, if multiple products share some common ingredients, would be best to produce.

A reference was made earlier to pricing strategies and formulas; which rules are important from the buyer's perspective, looking at a single ingredient pricing only (Dorfman, 2014)?

- ✓ The product breakeven pricing rule, which takes into account the speed or efficiency of the facility, as well as the direct variable costs (including labor and ingredients) and overhead costs.
- ✓ The product target gross profit margin (contribution margin) pricing rule.
- ✓ The ingredient breakeven pricing rule to solve for the ingredient cost and to determine the maximum price a buyer should pay for the ingredient to breakeven.
- ✓ The ingredient target gross profit margin pricing rule would provide a buyer with the price to pay for an ingredient in order to achieve the target profit margin, conditional on the output price already set or established.

The product breakeven pricing rule looks at only the production cost, using average variable cost, $AVC_{\$/lb} = c(q)/q + r + u/Q$, where c = labor cost, r = ingredient cost, and u = utilities cost.

The product target gross profit margin price will be greater than the breakeven price, to allow for the desired contribution margin, Target Price = $[1/(1 - \text{gross margin})] \times P_{\text{breakeven}}$. The breakeven price is inflated by the target gross profit margin.

The ingredient breakeven price formula becomes $P_{\text{breakeven}} = P - c(q)/Q - u/q$, and the ingredient target gross profit margin pricing rule is $r_{\text{gross margin}} = (1 - \text{gross margin})\text{price} - c(q)/q - u/q$, conditional on the output price being set.

These pricing rules are commonly discussed and solved in microeconomics and marketing classes, and provide at least suggested prices or price ranges for food and beverage processors and manufacturers who buy ingredients as an element of their supply chain so as to manufacture, package, and distribute their products to others in the food distribution system. But what about the ingredient producer and marketer – what are their pricing rules and considerations if they are trying to sell their input (ingredient) to a food processor or manufacturer when the ingredient source recognizes their food input can add value to the final product, differentiating it from similar food products? The ingredient itself becomes the product in the pricing rules cited above, whereby the breakeven price and the target profit margin price become the relevant pricing decisions for the ingredient provider in order to assure a desired profit or desired profit margin, for a minimum price. However, the question remains as to pricing the ingredient such that the value to the final product is realized by the final product manufacturer and hence, captured by the ingredient source.

As for pricing, a selling price by the ingredient marketer in excess of breakeven price (the cost of goods sold on a per unit basis when the ingredient is out-sourced from Georgia farmers) is obviously desirable. Therefore, the breakeven price is the average cost of acquiring plus marketing the product, and serves as the minimum price a salesperson should ever accept in making a deal. Hopefully, the malting house has included profit as a cost of doing business in

their calculations as well. Most companies also provide their salespeople with at least one target price, which is higher than the breakeven price, based on trying to achieve a particular profit margin. The target price formula is: $[1/(1 - \text{desired unit profit margin})] \times \text{average variable cost}$. But what if the firm wants to be rewarded with a price that adds value (not just cost-based) to the product, as in ingredient marketing? What are the pricing rules for ingredient sellers? And how will this value-adding price be construed by the buyer who may be price-conscious? The pricing rules for ingredient buyers are more established in theory, application and guidance than the pricing rules for the ingredient sellers, as discussed earlier.

Value-based pricing of malted grains (the ingredient) starts with customer (the craft brewery) needs, competitors' product-price positioning, and the micro-malting house's product-price positioning. Taking into consideration customer needs, customers' price sensitivity, and competing products, a price is developed around a product's relative strengths to create greater value for the buyer than competing products offer.

Typical analysis presented to potential buyers of malts goes beyond a description of the malted grains' flavor or unique characteristics and applications (ranging from 'no flavor or color contribution' to descriptions like 'pronounced smoke, upfront earthy mesquite, smooth, slightly sweet' or 'pronounced caramel, slight burnt sugar, raisiny' or 'smooth, slightly sweet malty, lightly toasted, biscuity, nutty, graham cracker, clean dry finish'), and whether the malt is available as organic. Other data provided in the analysis usually includes quantitative scores for [mealy %, half % and glassy %], plump %, through %, moisture %, extract FG% and extract CG% and protein % on dry basis, alpha amylase, ASBC DP measured as degree lintner, and color measurement using degrees Lovibond.

For start-ups, the inclusion of recognition and goodwill cannot be factored in as the firm has neither. Consequently, personal contact and relationships must be nurtured and developed so as to meet the needs and to deliver the ingredient, as specified, consistently. For reference, online price observations for malts (which included the sellers' margins) range from \$1.99 - \$2.49/lb for adjunct grain malts, \$1.49 - \$2.29/lb for base malts, \$34.99 - \$59.99/25 kg for bulk malts and \$74.99/25 kg for bulk organic malts, and \$2.49 - \$14.99/lb for specialty malts [www.BrewingWithBriess.com].

Conclusions

In order for the micro-malting house to be profitable, it will need to obtain some level of the market share of sales to the craft breweries within its target market. For the feasibility study described, the Atlanta, Georgia market was the focus of attention. Competitive advantage can be accomplished by producing consistently superior products at attractive prices. The prices charged for the ingredient (malted barley) will potentially be the largest obstacle to overcome because the larger, more established malting companies can charge lower prices due to their economies of scale. As a result, the micro-malsters must focus on quality and their ability to provide products as specified by their customers, the craft brewers. A hedonic price analysis was conducted using Atlanta market beer data. Results indicate there are four types (styles) of beer that have a high price premium: American India Pale Ale, Belgian Strong Pale Ale, Biere de Garde, and English Bitter. The malting company could take advantage of this information by producing malts that are used in the brewing of these styles of beer. Also, the craft beer industry in the US is still relatively small, although increasing in numbers of breweries. American

Adjunct Lagers sold by the largest brewing firms are still the most popular, and have been for decades. The hedonic model results show that consumers in the Atlanta area pay a premium for higher quality beer. For instance, a minimum of a 100-percent increase in price results from a one-unit increase in alcohol by volume (abv) for the “premium-priced” beers, whereas a decrease in price is observed for American IPA. The malting firm may therefore benefit from having a more “educated” consumer base in the target market.

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STATE EXCHANGES UNDER THE AFFORDABLE CARE ACT: POLITICAL OR ECONOMIC DETERMINANTS?

C. Barry Pfitzner, Hunter Mitchell, Tracy Moriconi, John Mosier, Sarah Parsons, Trang Tran,
Department of Economics/Business, Randolph-Macon College, Ashland, VA, 23005,
bpfitzne@rmc.edu, HunterMitchell@go.rmc.edu, TracyMoriconi@go.rmc.edu,
JohnMosier@go.rmc.edu, SarahParsons@go.rmc.edu, TrangTran@go.rmc.edu

ABSTRACT

This investigation estimates a probit model of the determinants related to the establishment of State exchanges under the Affordable Care Act. We find that “political” factors dominate the explanation of whether States set up exchanges, or relied on the “Federal Facilitated” marketplace. The model predicts correctly in 44 of 50 cases, based on a relatively small number of determinants. Those determinants are primarily political.

INTRODUCTION

The Kaiser Family Foundation lists each State’s type of exchange under the ACA. Twenty-seven states rely on the Federal government exchange, referred to as the Federally-facilitated marketplace. Fourteen states have State-based marketplaces, seven states have State-partnership marketplaces (these partnerships allows states to make key decisions and tailor their Marketplaces to local needs and market conditions), and three states have Federally supported marketplaces—meaning these states utilize the Federal IT platform. For the purposes of this investigation, we consider the latter three categories as “state” based exchanges. Thus those seeking healthcare through the exchanges rely on the Federal exchanges in 27 states and 23 states have some type of state-based/partnership exchange.

DATA

In addition to the data on the type of exchange by state under the ACA, we collected political and economic data we thought might be related to the decision to either set up a state-based exchange, rely on the Federally-facilitated marketplace. The data were collected for the year 2013 when exchanges were set up. We collected the following by state:

Ethnicity = percent white

Religion = percentage of the population who consider themselves to be very religious

Guns = percentage of the population who own firearms

Obama = percentage of the population who voted for Obama in 2012

Medicaid = a dummy variable equal to 1 if the state chose not to expand Medicaid, 0 otherwise

Governor = 1 if the governor was a Republican, 0 otherwise

Legislature = 1 if the legislature (both houses) was Republican, 0 otherwise

Age = mean age of the State’s population

Income = per capita income

Unemployment = rate of unemployment

Uninsured = percentage of the population uninsured in 2013
Poverty = percentage of the population below the poverty line

Clearly, other variables could have been collected. We chose these variables as primary indicators of political and economic conditions. Not all of the collected variables are utilized in the estimations presented in the paper.

METHOD AND RESULTS

Method

Sophisticated methods have been developed for analysis of dichotomous dependent variables in a regression. Standard linear probability models applied to such dependent variables are plagued with both violations of the general assumptions of the linear regression model as well as practical difficulties in interpretation. These problems include: (1) the error term is not normally distributed, (2) the error term is inherently heteroskedastic, (3) adjusted R^2 is not an accurate measure of fit, and (4) predicted values of the dependent variable are not bounded by 0 and 1 (see, for example, Studenmund [3], pp. 435-436).

Probit and logit models overcome the difficulties outlined in the previous paragraph. Essentially, these models transform the 0 or 1 nature of the dependent variable to an unbounded index (for predicted values) which corresponds to probability levels. Thus it is possible to assign probability levels to the likelihood of an event (here, the decision on exchanges), given values of the explanatory variable set.

Results

Table I contains the estimated equations for three specifications of the general equation. The first equation is that which we chose as our baseline—that is, we chose those economic and political variables we considered to be important, based on theory, in the decision to set up a state-based exchange or leave the implementation to the Federal government. The dependent variable is coded as 1, if the state has a state-based exchange, and is coded as a zero if the exchange is Federal.

Consider Model 1 in which we choose a combination of economic and political variables for an initial estimation. The two economic variables included in that estimation fail traditional tests of statistical significance. That is, *ceteris paribus*, the percentage of uninsured by state and the percentage of state families that live in poverty do not evince statistically important effects on the decision to implement state-sponsored exchanges or rely on the Federal exchange under the affordable care act. The political variables, whether the state chose to expand Medicaid, the party affiliation of the governor, and whether the legislature was controlled by the Republican Party, were all statistically significant and signed in accord with expectations. In short, states in which Republicans were politically dominant and Medicaid expansion was declined (with primary Federal assistance), were far less likely to implement state-sponsored exchanges.

Interestingly, Model 1 predicts correctly in 88% of cases ($R_p = 0.88$). That is, the model correctly predicted for 44 of the 50 states¹.

Table I: Dependent Variable = 1 for State Based Exchange, = 0 for Federal exchanges

Explanatory Variable	Model 1: mixed	Model 2: political	Model 3: economic
constant	1.096	0.4377	-11.78
% uninsured	-0.0207 (-.027)		-0.0850 (-1.26)
% Poverty	0.1322 (1.19)		0.291** (1.98)
No to Medicaid	-1.547* (-2.65)	-1.417* (-2.49)	
Governor Republican	-0.988** (-1.75)	-0.782*** (-1.495)	
Legislature Republican	-1.553* (-2.50)	-1.096** (-1.71)	
2012 Obama percentage		0.0237 (0.762)	
Income per capita			0.000123* (2.34)
Age			0.107 (0.976)
R_p	0.88	0.86	0.74
Pseudo R^2	0.631	0.617	0.23

(notes: t-scores in parentheses; Pseudo R^2 is that suggested by Estrella; *, **, *** represent statistical significance at $\alpha = .01, .05, \text{ and } .10$, respectively, for one-tailed tests.)

For Model 2, we include only the political variables from Model 1 while adding the percentage of the state's vote garnered by Barack Obama in 2012. The latter variable was statistically insignificant, but the other three (no to Medicaid, and party affiliation of the governor and legislature) were all signed in accord with expectations and statistically significant. The model based on political measures predicts correctly for 43 of the 50 states, only one fewer than the benchmark Model 1.

For Model 3, we estimate with economic explanatory variables. This estimation does suggest that two variables, the percentage of the state's population living in poverty and level of income per capita, have statistically significant effects on the decision to choose a state-sponsored

¹ The states predicted incorrectly by the model are Idaho, Michigan, Montana, Nevada, New Hampshire, and New Jersey.

exchange. Since both of these measures suggest a state-sponsored exchange is more likely, this result could reflect some influence of the *distribution* of income. That is, given the level of poverty, richer states are more likely to choose state-sponsored exchanges, and vice-versa. We do not place much confidence in this interpretation however. Perhaps some direct measure of the distribution of income may be important in the ACA decisions. At this point we have not entertained a measure of the state's income distribution. Overall, the fit of the "economic" model is poor relative to either the "mixed" model or the "political" model, judged by either the Pseudo R^2 or the cases predicted correctly (R_p).

In terms of probabilities of choosing a state based exchange, it is possible to compute the change in the probability for a given change in the explanatory variables. For roughly continuous variables, the simple partial derivative of the estimated equation with respect to x_i is calculated and then the change in the probability of the dependent variables from a one-unit change in that explanatory variable is computed. The explanatory variables in such an exercise are held at their means. If the explanatory variables are discrete (such as 0, 1 dummy variables), a different approach is preferred, since it makes little sense to change a dummy variable by one unit from its mean. In these cases we simply compute the probability from the estimated equation with the given dummy variable set at zero, and compare it to the probability estimated with the dummy variable set equal to one (see Wooldridge, 2013, pp. 586-587). For example, this would give an estimate of the change in the probability of adopting a state sponsored exchange for a state with a Republican governor, other variables held constant. In Table II, we present partial effects for the political variables estimation from Model 1. For the two roughly continuous variables, the uninsured percentage has approximately zero effect on the likelihood of adopting a state sponsored exchange, and a 1unit increase in the poverty rate raises the probability of a state-sponsored exchange by only .05. The reader is reminded that these variables were not statistically significant.

Table II: Partial effects on the decision to choose a state based exchange for the dummy variables based on Model 1

Explanatory Variable	Yes = 1	No = 0	Change
No to Medicaid	0.152	0.698	0.546
Governor Republican	0.351	0.728	0.376
Legislature Republican	0.265	0.822	0.557

The interpretation of Table II is straightforward. If a state chose not to expand Medicaid, the probability of choosing a state based exchange under ACA is estimated to be 0.152. If the state did expand Medicaid, the probability rises by more that 0.5 to almost 0.70. Similarly, in a state with a Republican governor the probability of a state exchange is estimated to be only 0.351. If the governor is from another party, that probability rises by 0.376 to almost 0.73. Finally, a state with a Republican legislature is estimated to have probability of only 0.265 of adopting a state

exchange (*ceteris paribus*). That probability rises to over 0.82, when the legislature is not dominated by the Republican Party.

CONCLUSIONS AND SOME QUALIFICATIONS

Several conclusions can be drawn from the estimations presented in this paper. First, the estimations allow accurate predictions for whether a given state chose to implement a state based exchange under the Affordable Care Act. In fact, only six states are predicted incorrectly by our base model. Second, based on the variables we collected to explain the decision on the type of exchange under the ACA, political variables (as opposed to economic variables) dominate the explanation. This is reinforced by separate “political” and “economic” estimations (models 2 and 3). Third, partial effect analysis from Table II, suggests very strong probability effects for each of the political variables.

A few caveats are also in order. First, the estimations in this paper rely on maximum likelihood estimation techniques. Some researchers argue for very large sample sizes for reliable estimation (see, for example Studenmund, p. 442). The sample size here is only, of course, the fifty states. The estimations do, *however*, predict accurately, which is our primary objective. Second, other researchers may choose an entirely different set of explanatory variables.² Third, though we have divided our explanatory variable set between economic and political variables, we acknowledge that the political variables *may* arise from the economic environment. That is, the party affiliation of government and whether or not to expand Medicaid could be choices based on economic grounds. Such implied causation may also be reversed. We choose not to speculate on these exact relationships.

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² We are aware of one other estimation of this type, be we are awaiting permission to cite.

Heuristics in Business and Economics: A Survey

Reza Kheirandish, College of Business, Clayton State University, Morrow, GA

Shabnam Mousavi, Carey School of Business, Johns Hopkins University, Baltimore, MD

According to Gigerenzer and Gaissmaier (2011), “Heuristics, are efficient cognitive processes, conscious or unconscious, that ignore part of the information”. In this view, heuristics are simple rules of thumb that can be successfully used in situations of irreducible uncertainty and complexity. The more dominant view of heuristics, heuristics and biases, studies instances where people make less than rational or biased judgments, and attaches these instances often to the use of heuristics. In their initial research, Tversky and Kahneman (1974) argued that three heuristics, namely availability, representativeness, and anchoring and adjustment can be used to explain the processes underlying a wide range of intuitive and often fallible judgments. Interestingly, social scientists are not the only group, or the first group, who use and study heuristics. Engineers, computer scientists, and mathematicians, as well as theoreticians in many scientific fields have been using heuristics, simple rules, and rules of thumb extensively as strategies for problem solving. Gathering the ways in which different fields define heuristics and spelling out the similarities and differences between these definitions is a theme of this paper. The other, more specific goal is to survey the different conceptions of heuristics stemming from different psychological approaches to human decision-making processes. The paper demonstrates which concepts have or have not been extended to economics and other business disciplines. It specifies instances where the study of adaptation, use of heuristic strategies, and less-than-rational behavior is modeled in behavioral economics. It argues that in cases where the predominant conception of heuristics has been adopted in behavioral economics, the implications for understanding and describing decision processes can be traced back to the traditional neoclassical economic theory of rational decision-making. Finally, it illustrates the ways in which the less explored extension of simple heuristic strategies to economic behavior holds operational promises, which can shed light on our understanding of puzzling behavior in economic markets. Examples from the prevalent use of simple rules in entrepreneurial domain provide a fruitful area for turning the focus of the study of heuristics from being a source for biased judgment to a functional way of treating the actual problem at hand.

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SCENARIO BASED TESTING IN AN UNDERGRADUATE ORGANIZATIONAL BEHAVIOR CLASS

Edward D. Showalter, Department of Economics, Business, and Accounting
Randolph-Macon College, Ashland, VA, edshowalter@rmc.edu, (804) 752-3716

George S. Lowry, Department of Economics, Business, and Accounting
Randolph-Macon College, Ashland, VA, glowry@rmc.edu. (804)752-7306

ABSTRACT

This paper presents a method of student learning assessment using a narrative scenario and a series of questions as a way to measure learning in an undergraduate organizational behavior class. Scenario based training and testing has been used in several areas outside the classroom, but has been used less in a typical business class setting. Suggestions on the creation of scenarios are presented and an example scenario and grading rubric are included.

Introduction

Assessment of higher level learning of Organizational Behavior (O.B.) concepts can be a difficult task. Bloom's (1956) classic learning taxonomy is divided into six cognitive process dimensions: Remember, Understand, Apply, Analyze, Evaluate, and Create. Simple multiple choice testing works quite well for the lower levels, but to assess a student's ability to Apply, Analyze or Evaluate requires more comprehensive assessment. This paper presents a scenario based method of assessment used in an undergraduate OB class.

A scenario, simply put, is a story. The models and concepts addressed in an OB course can be and have been used to describe and analyze the behaviors and relationships in literature, film, etc. In fact many OB textbooks make reference to such fictional stories. The same process can be used for assessing a student's level of learning using a carefully crafted scenario as the basis of an examination.

Appendix A presents a sample testing scenario with a set of questions, and Appendix B presents a potential rubric for grading the students' responses.

Literature

The use of scenarios is commonplace in business and government operations. They are employed to help generate forecasts of future events such as product demand, resource allocation, and even ways to cope with crises. In the realm of software engineering, scenario-based testing is widely used for quality assurance to better specify system requirements to meet various user needs (see Ryser & Glinz and Lettari & Klose for examples.) Challenging the system's design with possible alternate cases affords the opportunity to make improvements.

Scenario-based learning is a training method used to equip workers with the appropriate behaviors, scripts, and expectations when confronted with predictable situations. As a backward-looking approach, past events can serve as scenarios to help prepare for events with low probabilities such as natural disasters and other crises. (Moats, et al., Schnaars.)

Little evidence exists showing the use of scenarios in business education beyond traditional case-based courses. An exception is the use of scenarios to measure academic integrity and ethicality

(Low, et al., Chapman, et al., Desplaces, et al.). Of interest in this paper is the use of scenarios as the basis for evaluating student learning as a substitute for traditional test formats. The medical field uses this approach to some degree, often focused on diagnostics. (Feingold, et al.)

Implementing Scenario Based Testing

For an instructor to successfully use scenario based testing, students must be properly prepared. One way to do this is a class exercise prior to the actual exam using a modified scenario and walking the class through the process. It is important to clearly state multiple times that a full answer will 1: Identify the most appropriate OB model covered in the material to the question asked, 2: Clearly outline the model including definitions of key terms, 3: Clearly apply the model to the scenario, answering the question that is asked. Note that the grading rubric is set up exactly in this manner and it may be helpful to share the rubric with the students prior to the exam.

The process that has been the most successful in the application of scenario based testing for the authors has been a series of exams throughout the semester, each scenario-based, and each building on the previous exam. For the second exam, the student receives the scenario from the first exam, without the questions, as well as an equally long “second chapter” that expands on the scenario, perhaps adding new characters, a new situation, etc. The final exam provides the students with the first and second scenarios, and adds a third “chapter”.

As the scenario builds over the course of the semester, by the final exam the students are presented with a highly complex three tier scenario, but are reading only one-third of it for the first time. As they prepare for the final, they can be encouraged to think about what they already know about the scenario to date and begin to study by applying the new models to the old information. It is not unusual for students to develop an attachment to the characters in the scenarios by the final exam, much as they would characters in a serial drama.

One final note about re-using scenarios: The authors suggest developing a new scenario each iteration of the class in order to avoid contagion from semester to semester, or year to year. At the very least, the questions asked should be changed.

Suggestions for Creating OB Testing Scenarios

1. Scenarios should be sufficient in length and depth to provide the students with enough information to make inferences and see elements of the models and concepts taught in the class.
2. Scenarios should be brief enough to be completely read in just a few minutes. This gives the students sufficient time during the testing period to read the scenario carefully and refer back to it while having sufficient time to answer the questions asked.
3. Separate the scenario from the questions. This allows for a specific set of questions to be asked that guides the thinking of the students toward the proper concepts. This also allows the scenarios to be re-used in future semesters without editing the scenarios by simply adjusting the questions.
4. Elements to include:
 - Organization overview
 - Description of key personnel
 - Description of internal tension
 - An external pressure
 - A potential impending change

These elements should be woven together in the narrative rather than laid out in a clear linear fashion. This encourages the student to find important connections across the entire scenario, a key part of the “analyze” level of learning.

Conclusion

As with any potential method of presenting material and assessing student learning, scenario based testing may not appeal to all students or to all instructors. It is substantially different than the forms of assessment most students are familiar with, however in the author’s experience, many students come to like it. This form of assessment, however, is not easy to create or to score, and therefor requires a substantial commitment of time from the instructor. Aside from the standard problems in grading essay format tests (e.g. reading student’s handwriting, grammatical errors, etc.) this form of testing requires flexibility on the part of the instructor in discerning whether or not answers are correct. While certain models are obviously wrong, the field lends itself to multiple correct answers. While some of these may be better or worse than others, if they are well supported they deserve adequate credit. In addition, grading time can be substantial, especially if the instructor addresses both writing issues and content issues.

The difficulties in developing scenarios, implementing the process, and grading the student responses aside, the process can be extremely rewarding for both the student and the instructor.

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Organizational Behavior: Scenario for Exam 1

Hit-the-Road Helmets is a small company manufacturing bicycle helmets primarily targeted toward the recreational rider and the racing enthusiast markets. The company has attempted to develop a collegial culture, where each of the employees feels a part of the Hit-the-Road team. The company is comprised of two operating divisions: Recreational and Racing. The Recreational division is larger in size than the Racing division, both in sales and in number of employees. The people who work in the Racing division tend to be very dedicated to the bicycling industry, and are often ex-professional racers who enjoy creating a quality product for the sport.

Over the past several years, Hit-the-Road management has installed a profit sharing plan in which employees participate based on the percentage of profits generated by their division, Recreational or Racing. The members of the Recreational division have traditionally received a larger profit sharing check than the members of the Racing division because the division is substantially larger and the products cost less to produce, thus generating a greater profit for the Recreational division. From time to time, this difference in profit sharing has caused hard feelings on the part of members of the Racing division who feel they work just as hard as the members of the Recreational division, yet receive less profit sharing money. Unfortunately, despite the higher profit sharing checks, the Recreational division has a higher turnover rate and higher absenteeism than the Racing division, and there is the perception that the Recreational division employees are less satisfied.

Dave Carpenter has been successfully racing mountain bikes as a professional for the last five years. Having just retired from racing, Dave joined Hit the Road Helmets (HTRH) six weeks ago, and was immediately assigned to a task force group designing a new mountain-bike helmet, the XJ7. The task force consists of five other employees, two from the racing division, two from the recreational division and one other new employee who also has experience in mountain bike racing. The president of HTRH appointed George Lemond, one of the racing division members on the task force, as group leader.

A market report done a few months earlier suggested that dealers desired a completely new design for a mountain-bike helmet. After numerous meetings and drafts, the task force decided to create the new XJ7 Helmet by re-designing a previous model. Dave is against this idea, believing that the needs of the mountain biker are substantially different from the needs of a road racer, however he has gone along with the group to avoid "rocking the boat."

- 1. Discuss the issues of organizational commitment that might be relevant. Which group is likely to be more committed to the organizations, what types of commitment are strongest and how might commitment be improved?**
- 2. Discuss your impressions of the personality of Dave Carpenter. How likely do you think your impressions are to be correct and why?**
- 3. Discuss your impressions of the decision-making process the team may have used to reach its decision? How could the decision-making process have been improved?**
- 4. Why might the members of the Recreational division be less satisfied than the Racing Division members? (Hint – discuss issues of job-design)**

Advice: in answering the questions, remember to clearly identify and describe the models and theories used and clearly identify any assumptions you make regarding facts not in the case.

Org. Behavior: Exam 1 - Grading Sheet

Name: _____

	Points Available	Points Earned
Question 1:		
Model Chosen:	5	
Accuracy of Model Description	5	
Application	5	
Definition of Key Terms and Writing	10	
Total Points: Question 1	25	
Question 2:		
Model Chosen:	5	
Accuracy of Model Description	5	
Application	5	
Definition of Key Terms and Writing	10	
Total Points: Question 2	25	
Question 3:		
Model Chosen:	5	
Accuracy of Model Description	5	
Application	5	
Definition of Key Terms and Writing	10	
Total Points: Question 3	25	
Question 4:		
Model Chosen:	5	
Accuracy of Model Description	5	
Application	5	
Definition of Key Terms and Writing	10	
Total Points: Question 4	25	
Final Grade	100	

Notes:

AN EXPERIENTIAL SUSTAINABILITY PROJECT DESIGNED FOR AN OPERATIONS MANAGEMENT CLASS

Michael S. Hutkin, Roanoke College, Salem, VA 24153, 540-375-201, mhutkin@roanoke.edu
Christina D. McCart, Roanoke College, Salem VA 24153, 540-375-2414, mccart@roanoke.edu

A priority at our small liberal arts college is to engage students through experiential learning projects. Experiential Learning was the Quality Enhancement Project (QEP) established as part of “*Roanoke Pathways: From experience to experiential learning*” where “*Roanoke College's Pathways Program seeks to improve student learning by enhancing the quality and visibility of experiential learning opportunities currently available to our students: research, internships, service-learning, study away, and creative/artistic works.*” This program was agreed upon when we last went through our SACS accreditation and as a result so many of us actively pursue opportunities while still recognizing the many constraints all projects face in their execution.

The purpose of this presentation is to describe an experience based, on campus project developed and used in an undergraduate operations management class that addresses the tenets of the QEP.

As proponents of sustainability, the authors seek out opportunities to help students understand that being environmentally and socially responsible can be the most profitable course of action for long term business success - People, Planet, Profit. Since our college promotes experiential learning we seek projects that can be taught experientially. Another recent college initiative is to reduce energy expenses; toward that end the college hired a consulting company which has an Energy Specialist on campus. His job entails identifying energy saving opportunities and working with the college’s personnel to execute implementation strategies.

This project developed for our operations management class was seen as a win/win/win for the authors. It gives our students an experiential learning opportunity, it shows them that not all cost cutting measures are equal, it provides suggestions which if acted upon could reduce the college’s carbon footprint, and it provides the opportunity to save the college money which in these challenging times is yet another major college initiative.

In consultation with our energy specialist, we developed five different projects:

- Evaluating the energy use in our College of Business (COB) building.
- Another project focuses on energy use of the inhabitants of the same building.
- Vending machines.
- Washing machines and dryers.
- Campus Vehicles.

The projects were designed to encompass different operations techniques, including forecasting, payback, inventory control, facility layout and design, quality assurance and the human resource implications of any changes. This project took place over the Fall of 2015. In February we will present the projects in more detail including the results of the projects, the lessons learned, and suggestions for future projects.

Window 10, Office 2016 – Microsoft’s New Products

Wilma M. Andrews,
Virginia Commonwealth University
Department of Information Systems
Richmond, VA. 23284-4000, 804-827-0956, wandrews@vcu.edu

Robert L. Andrews,
Virginia Commonwealth University
Department of Supply Chain Management and Analytics
Richmond, VA. 23284-4000, 804-355-4645, randrews@vcu.edu

ABSTRACT

Windows 10, Office 2016, and other new Microsoft products are now being used by many students and educators. This workshop will look at features of Windows 10, Office 2016, Office Mix and Edge as well as other products coming on the market of interest to educators. Session participants hopefully will also be asked to share about products they are using to enhance their teaching and research.

Windows 10

Windows 10’s was released last summer and it is a free upgrade for Windows 7 and 8 users. Back by popular demand in Windows 10 is the Start button with familiar features with Tiles as found in Windows 8. New features include the Action Center and Cortana, your Personal Assistant. File Explorer has some new features like the Quick Access area where file and folders can be pinned and unpinned.

Office 2016

Released in October 2015, Office 2016 has few major changes to small learning curve for users. The “Tell Me” tool in Word, Excel and PowerPoint helps users perform various tasks. Excel now includes Power Query as a built-in rather than an add-in. Slicers have been enhanced to work better with touch screens. Real-time co-authoring is finally a realization in Word with Excel and PowerPoint coming later.

Office for Windows 10 apps has applications in Word, Excel, PowerPoint and OneNote.. These applications are for Windows phones and tablets

Office Mix

Though introduced in 2014, many are still not aware of Microsoft’s **Office Mix** in PowerPoint. It is a free download for Office 2013 and above or Office 365 on PCs. Recording of lectures/training is possible because of its multimedia capabilities. The files are stored in the Cloud and can be made available using a link.

Edge

Edge is Microsoft’s new browser that replaces Internet Explorer.

Other products

Sway is a new app in the Office portfolio and **HoloLens** which Microsoft says “ combines breakthrough hardware, input, and machine learning so you can bring mixed reality experiences to life using the real world as your canvas.”

Lessons from a Summer in Silicon Valley

Donna M. Schaeffer, PhD Marymount University, Arlington VA
and Patrick C. Olson, PhD National University, San Jose, CA

Abstract

Making the work of a faculty member relevant to a community of practice and attractive to new students is always challenging. In the case of Information Systems, the challenge is enhanced by continuous change and because of the importance Silicon Valley plays in the field. Silicon Valley is a very busy place with little time for the explanations needed to inform our field; the higher education institutions in Silicon Valley have their entire capacity consumed in support of the “Valley” leaving not enough resources to inform the rest of higher education. In effect, our students will be entering their professional live in 2 to 5 years, and Silicon Valley is defining these jobs now.

The authors had several means of access to the ongoing life of Silicon Valley, which include The Churchill Club; the Tech Museum of Innovation; the Computer History Museum; and various “Meet Ups”. The Churchill Club was founded in 1985 for the purpose of “Igniting Conversations to Encourage Innovation, Economic Growth and Societal Benefit.” It requires membership and attracts speakers and panels that have included CEOs, Government Leaders and panels of industry and academic leaders. The Tech Museum of Innovation is a center for innovation and education in San Jose. Its focus is on science and technology and is an amazing hands on museum. Founded in 1979, the Computer History Museum moves to California from Boston in 1999. In many ways this institution is the central archive for computing, including hardware, software, and the biographies of the people that made them possible. “Meet up” are events usually hosted at companies working in the area of the “Meet up” topic. These meetings include people working in the industry who have interest in the topic as well as managerial and academic leaders.

The authors categorize two dozen meetings and discuss the topics, trends, techniques and culture revealed by the events in the summer quarter of 2015 as viewed in Silicon Valley. The intended result to inform better teaching, curriculum development, selection of topics for scholarship, implementation and adoption of technology, and speculation about implications for the future. The intended audience is our colleagues working in information systems and computing in higher education but the paper will like have utility to a broader audience.

Cybersecurity: Learning from the Remarkably Effective Process of Hacking

Wayne Smith, Ph.D., CEH
Software Engineer, Avtec, Inc., Lexington, SC
wasmith777@gmail.com

With all the headlines about break-ins, there is no shortage of fear about our level of exposure as individuals and institutions. Furthermore, our confidence in counter-measures shrinks with each announcement – especially when seemingly unsophisticated hackers appear to have such great impact. This talk takes a peek into how hackers have honed their processes into efficient and effective methods for accomplishing seemingly impossible goals. Along the way, we'll look for lessons we can learn to improve our security.

**THE INTERACTION OF GENDER AND PERSONALITY
AND THE DELIVERY OF QUALITY KNOWLEDGE-BASED WORK ARTIFACTS**

**Competitive Paper Submitted to:
Southeastern-Decision Sciences Institute
2016 Annual Conference**

By

Nicholas W. Twigg, DBA
ntwigg@coastal.edu

Janice A. Black, PhD
janblack@coastal.edu

J. Kay Keels, PhD
jkeels@coastal.edu

**Department of Management and Decision Sciences
E. Craig Wall Sr. College of Business
Coastal Carolina University**

Abstract: When confronted with permeable boundaries, knowledge-based teams are faced with dynamic team members which causes them to take on the characteristics of a short-term team. Higher education has long experience with the management of short-term knowledge-generating teams. This paper examines higher team performance and the interaction of personality profiles and gender along with other team effectiveness constructs found to impact the quality of team deliverables. Earlier work has found that personality profiles are important for effective teams when men are considered, but not when women are considered.

This work builds on the past investigation of what is important in order to produce quality team deliverables. Specifically, it examines the interaction of gender and personality and the impact on the quality of knowledge-embedded deliverables. Personality profiles are examined more closely to determine if any one profile drives the overall significance or the interaction results. Quality of final written and oral artifacts are decomposed and examined for each condition as well to determine if any of the aforementioned attributes are dependent upon the type of knowledge deliverable rendered.

The paper begins with a brief review of short-term team attributes. Next, the presentation of knowledge-embedded artifacts is overviewed. Finally, hypotheses related to gender and personality type are developed. The hypotheses are tested and results are presented.

EFFECTS OF THE PLANNED ENTREPRENEURIAL BEHAVIOR ON THE ENTREPRENEURIAL INTENTION

Ahu Tuğba Karabulut, Faculty of Commercial Sciences, Istanbul Commerce University,
İmrahor Cad. No:90SütlüceBeyoğlu İstanbul Turkey, E-mail: tkarabulut@ticaret.edu.tr
This paper is funded by Istanbul Commerce University

ABSTRACT

The purpose of this study is to explore the effects of the planned entrepreneurial behavior on the entrepreneurial intention of Turkish graduate students based on Ajzen's TPB (1991). The author was inspired by Orman's (2009) study. This study was conducted on 480 graduate students in a foundation university in Turkey. Factor analyses and multiple regression analysis were conducted to the data. It was found that the planned entrepreneurial behavior had a positive effect on the entrepreneurial intention.

THE THEORY OF PLANNED BEHAVIOR (TPB)

Ajzen (1991) developed the theory of planned behavior (TPB) to predict intentions. The TPB which is widely used to predict entrepreneurial intentions in the literature has the following dimensions: attitude toward the behavior, subjective norm and perceived behavioral control. It provides a comprehensive model for evaluating different dimensions of behaviors towards entrepreneurial intentions. According to empirical data, attitude toward a behavior, subjective norm, and perceived behavioral control affect entrepreneurial intention. The TPB is used in this study to figure out entrepreneurial intentions of graduate students.

The Theory of Planned Behavior (TPB) is the extension of the Theory of Reasoned Action (Ajzen and Fishbein, 1980) which proposes that intention is the predictor and determinant of behavior. On the other hand, the major limitation of this theory was that behavior was not completely voluntary and controlled. Thus, Ajzen (1991) included perceived behavioral control to the TPB (Orman, 2009: 16-17).

The theory of planned behavior (TPB) (Ajzen, 1991; 1985) is one of the most effective model to predict social behavior. It focuses on predicting intentions. Behavioral, normative and control beliefs; attitudes, subjective norms and perceptions of behavioral control explain behavioral intentions (Ajzen, 2011: 1113-1115).

The TPB (Ajzen, 1988, 1991) is one of the most popular psychological theory which predicts entrepreneurial intentions (Carr and Sequeira, 2007; Kolvereid, 1996; Krueger and Carsrud, 1993; Tkachev and Kolvereid, 1999). Researchers mention that since the entrepreneurial behavior is intentional, intentions are predicted by behaviors (Bird, 1988; Krueger and Carsrud, 1993) (Kautonen et al., 2011:220).

The TPB is used in studies which explore entrepreneurial intentions (Díaz-García and Jiménez-Moreno, 2010; Liñan, 2008; Liñan and Chen, 2009; Liñan et al., 2010; Moriano, Gorgievski, Laguna, Stephan, and Zarafshani, 2011) (Shinnar et al., 2012: 471).

Ajzen (1991) believes that the theory of planned behavior (TPB) shows that intentions have the following determinants: attitude toward the behavior, the subjective norm and perceived behavioral control. He (1991) acknowledges that attitude toward the behavior is “the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question.” He (1991) states that the term subjective norm is “the perceived social pressure to perform or not to perform that behavior.” He (1991) adds that perceived behavioral control is “the perceived ease or difficulty of performing the behavior” (Kautonen et al., 2011: 220-221).

Three determinants of intention are as follows in the TPB (Orman, 2009: 17):

1. Attitude Toward the Behavior is a person’s belief and expectation about potential consequences of a behavior. A person will have a positive attitude to perform a behavior if he or she believes its consequences are favourable (Kuehn,2008).
2. Subjective Norm defines perceptions of significant people about the behavior performed. It shows the perceived social pressure for performing a behavior (Kuehn, 2008).
3. Perceived Behavioral Control describes perceptions of a person about the difficulty of the behavior and his or her ability to perform it (Krueger,2000).

“Attitudes, subjective norms, and perceived behavioral control determine behavioral intention” in the TPB. Behavioral intention which indicates the amount of effort a person does for performing a behavior gets the motivational factors causing a planned behavior. When behavioral intention increases, a person can perform a behavior in the TPB (Cordano and Frieze, 2000: 628).

Ajzen (1991) believes that the TPB explains that behavior’s performance is intentions’ and perceived behavioral control’s function. He (1991) claims that intentions are determined by perceived attractiveness of the behavior, perceived subjective norms about the behavior, and perceived behavioral control. He (1991) highlights that the attitude toward the behavior is evaluation of the behavior of a person. He (1991) claims that the perceived subjective norms is important people’s perceptions to perform the behavior. He (1991) explains that “the perceived behavioral control is the perceived ability to perform the behavior” (Yordanova and Tarrazon, 2010:246-247).

Ajzen (1985, 1991, 2005) states that behavioral beliefs determine attitude, normative beliefs determine social norms, and control beliefs explain perceived behavioral control. He (1985, 1991, 2005) summarizes that behavioral beliefs are “expected consequences of a behavior and the evaluation of those consequences.” He (1985, 1991, 2005) highlights that normative beliefs show whether a person expects important referents to approve the behavior, and the motive of a person to comply with these referents (Tegtmeier, 2012:155).

The TPB (Ajzen, 1985, 1987, 1991) has three variables which measure attitudes, subjective norms, and perceived behavioral control determining behavioral intention. Attitudes examines disposition of a person toward a behavior. Subjective norms consists of attributes of social environment of a person. Perceived behavioral control shows ability of a person for controlling the behavior performance. Behavioral intention is the immediate antecedent to a behavior in the TPB. Ajzen claims that when a person's attitude toward the behavior becomes more favorable, his or her intention for performing a behavior increases. Subjective norms has a social component which measures the perceived social pressure for performing or not performing a behavior. Subjective norms is a function of a perception of a person about important referents' behavior evaluation and motivation of a person to conform to them. When subjective norms is more favorable, a person's intention for performing a behavior increases (Cordano and Frieze, 2000:628).

Krueger et al. (2000) believe that long term tendencies can be predicted by focusing on intentions by using TPB. Since, entrepreneurial process is a planned process, the intentions-based TPB is relevant to entrepreneurial activity. Shook et al. (2003) believe that studies in the field of entrepreneurial intentions of students have drawn upon TPB most of the time. There is an empirical support that using TPB is beneficial for studies in the field of entrepreneurial intentions of students (Krueger et al., 2000; Li, 2007; Wu and Wu, 2008; Van Gelderen et al., 2008) (Carey et al., 2010:506).

Huang (2011) conducted a study by applying Ajzen's (1991) TPB to examine intentions of college students to have contingent employment in Taiwan. He (2011) found out that attitude and subjective norms were significant to predict intention. On the other hand, he (2011) added that "relationship between perceived behavioral control and intention was not significant." He (2011) summarized that "subjective norms predicted intention indirectly through attitude." Arnold et al. (2006) claim that more efforts are required to explore the TPB for career choice and development (Huang, 2011: 455-457).

Damron-Martinez et al. (2013) conducted a research to non-business major undergraduate students to figure out the factors which affected their intention to choose a business minor by TPB. Their findings (2013) supported the TPB that "attitude, perceived behavioral control, and subjective norms were significant predictors of intention."

Tegtmeier (2012) conducted a study to reveal empirical implications to promote entrepreneurial intention of students by using the TPB of Ajzen (1985, 1991). She (2012) found that attitude, social norm, and perceived behavioral control contributed to predict entrepreneurial intentions.

Many researchers explored drivers for university students to establish their own businesses. Carey et al. (2010) have conducted a study to examine intentions of university students to start several types of businesses by using Ajzen's TPB. They (2010) have found that "intentions to start small high income and high growth ventures share many commonalities and are significantly driven by behavioral beliefs and perceived behavioral control."

Tkachev and Kolvereid (1999) found out that attitude, subjective norm and perceived behavioral control were correlated with entrepreneurial intentions of Russian and Norwegian university students in a study for testing the TPB. Linan and Chen (2009) showed that personal attitude and perceived behavioral control affected the entrepreneurial intentions of Taiwanese and Spanish people. They (2009) added that the effect of subjective norm was indirect through its positive effect on personal attitude and perceived behavioral control. Autio et al (2001) tested TPB on university students from Finland, Sweden, USA, and UK. They (2001) showed that personal attitude, subjective norm, and perceived behavioral control affected the entrepreneurial intention. They (2001) added that perceived behavioral control had the strongest effect whereas subjective norm had the weakest effect on the entrepreneurial intention (Orman, 2009:18-19).

ENTREPRENEURIAL INTENTION

An entrepreneur is a person who takes calculated risks to establish a new venture to provide value to stakeholders. The intention of a person to establish a business can be defined as an entrepreneurial intention. Entrepreneurial intention is important for people to choose entrepreneurship as career paths. Nowadays, more educated people prefer to be entrepreneurs. People who have graduate degrees may consider self-employment and establish their own businesses. They may believe that when they have more education, their businesses can be more successful. Thus, entrepreneurial intention of graduate students is the main focus of this paper.

Krueger (1993, p. 6) believes that entrepreneurial intention is “the target behavior of starting a business.” Krueger and Thompson (2009) believe that intentions are predictors of behavior, and the intention to start a venture initiates the process of venture establishment (Bullough et al., 2014: 475-476). Bullough et al. (2014: 476) defines entrepreneurial intention as a cognitive state which shows a person’s decision to own a business. Krueger (2000) claims that entrepreneurial intentions arise from desirability and feasibility perceptions of entrepreneurial action (Bullough et al., 2014:476).

Shapero and Sokol (1982) believe that intention is based on (a) perception of a person of the proposed behavior’s desirability; (b) tendency of a person to act; and (c) perception of a person of the behavior’s feasibility (Gaddam, 2008:37).

Intention which is under volitional control is the immediate antecedent of the behavior. Ajzen (1985: 18) believes that several factors affect the relationship between intention and behavior (Buchan, 2005: 166).

According to Ajzen (1991, p. 181), intentions are “indications of how hard individuals are willing to try, of how much of an effort they are planning to exert to perform the behavior.” He (1991) adds that when the intention is stronger to engage in a behavior, the performance is stronger. He (1991, 2002) claims that an “intention is the immediate antecedent of behavior” (Kautonen et al., 2011: 220-221) (Orman, 2009: 8).

According to Ajzen (1991), intentions show a person's motivation and efforts for performing the behavior. He (1991) underlines that intentions are associated with the likelihood to perform the behavior. He (1991) adds that "the link between intentions and behavior depends on the extent to which behavior is under volitional control." He (1991) acknowledges that the behavior's performance is partially under volitional control and based on resources and opportunities (Yordanova and Tarrazon, 2010:246-247).

Bagozzi et al. (1989) and Kim and Hunter (1993) believe that intentions are planned behavior's predictors and certain attitudes predict intentions. Ajzen (1991) highlights that intentions depend on social norms, attractiveness and feasibility perceptions. Shapero (1982) states that entrepreneurial intentions depend on desirability and feasibility perceptions and the propensity for acting (Kristiansen and Indarti, 2004: 60).

Fishbein and Ajzen (1980) define the attitude as the situation of a person who react favorably or unfavourably toward a person, an object or an event different from his or her own world. According to Hajer and Habib (2013: 674) "the beliefs determine the attitudes (the emotional direction) acting on the intentions to behave (cognitive dimension) and on the behavior (action)" (Hajer and Habib, 2013: 674).

According to Ajzen (1991, 2005) an attitude can be predicted based on accessible beliefs about behavior. Ajzen (1985, 2005) acknowledges that people can perform a behavior if (1) their assessments of that behavior are positive, (2) they believe important referents agree with that behavior, and (3) they consider that there are resources and opportunities to perform that behavior. He (1985, 2005) states that intention is the antecedent of the behavior if perceived behavioral control and actual control over the behavior are same. He (1985, 2005) adds that new information which prevents behavior performance can change intention (Tegtmeier, 2012:153-154).

Ajzen (1991) and Ajzen and Fishbein (1977) believe that intentions show a self-prediction to conduct a behavior. According to Bagozzi, Baumgartner and Yi (1989), social-psychological studies consider that intention is the main predictor of the behavior. Several studies reveal that entrepreneurial intentions are important antecedents of entrepreneurial actions (Krueger et al., 2000; Lee, Wong, Foo, and Leung, 2011) (Bae et al., 2014: 219).

Entrepreneurial intention leads entrepreneur's actions toward the development of the business concept. People have attitudes to perform a behavior considering its consequences. Behavioral intention is caused by attitudes and is the determinant of a behavior. Fishbein and Ajzen (1975) claim that intentions are a function of beliefs, connect beliefs and subsequent behavior. Their (1975) proposal is as follows: Beliefs → Attitudes → Intentions → Behavior. They (1975) suggest that there is a relationship between the intention to perform a behavior and behaviour's performance. They (1975: 369) propose that if a person wants to learn whether or not another person will perform a certain behavior, he or she can ask that person whether he or she intends to perform that behavior (Boyd and Vozikis, 1994:64).

Gaddam (2008: 35) explored to identify the relationship between behavioral motives and entrepreneurial intentions of MBA students. Azhar et al. (2010) conducted a study to determine entrepreneurial intentions of students who had business majors in Pakistan based on the “Entrepreneurial Intention Model” of Planned Behavioral Theory.

METHODOLOGY

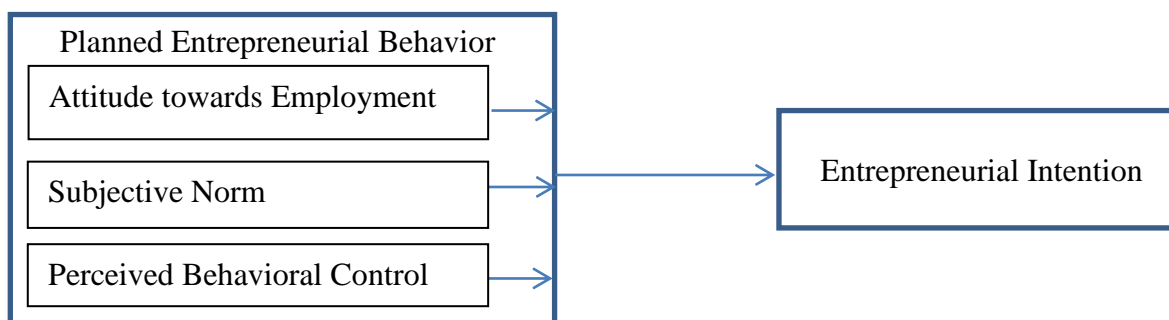
The purpose of this study is to explore the effects of the planned entrepreneurial behavior on the entrepreneurial intention of Turkish graduate students based on Ajzen’s TPB (1991). The author was inspired by Orman’s (2009) study. The hypotheses and research questions were taken from the dissertation of Orman (2009).

Sample and Data Collection Method

The study was conducted on graduate students in the foundation university in Istanbul, Turkey. There were 1800 graduate students in the Institute of Social Sciences of this foundation university. The questionnaire was sent to 1660 students whose e-mail addresses were valid by e-mail. There are 480 usable questionnaires for the study. The population of this study was 480 graduate students in the Institute of Social Sciences in this foundation university. These questionnaires were analyzed and findings were presented. The factor analysis and multiple regression analysis were applied to the data.

Research Model of the Study

The research model of the study is as follows:



Hypotheses of the Study

The hypotheses of the study are as follows:

- H1: Planned Entrepreneurial Behavior Affects Entrepreneurial Intention
- H1a: Attitudes Toward Employment Affects Entrepreneurial Intention
- H1b: Subjective Norm Affects Entrepreneurial Intention
- H1c: Perceived Behavioral Control Affects Entrepreneurial Intention

Measures of the Study

Questions of this study were taken from Orman's (2009) study.

TABLE 1. QUESTIONS OF THE STUDY

	Source	Question
Employment Preference	Kolvereid (1997)	How likely is it that you will pursue a career as employed in an organization?
	Orman (2009)	How likely is it that you will pursue a career as employed in government offices?
	Kolvereid (1997)	How likely is it that you will pursue a career as self-employed?
Reasons for Becoming Organizationally Employed	Kolvereid (1997)	Job security
		Job stability
		Not having to work long hours
		To have leisure
		To have fixed working hours
		Not to have a stressful job
		Have a simple, not complicated job
		Participate in a social environment
		To be a member of social "milieu"
		Avoid responsibility
		Not taking on too much responsibility
		Avoid commitment
		Have opportunity for career progress
Reasons for Becoming Self-employed	Kolvereid (1997)	Promotion
		Economic opportunity
		To receive compensation based on merit
		To keep a large proportion of the result
		To have a challenging job
		To have an exciting job
		To have an interesting job
		To have a motivating job
		Freedom
		Independence
		To be your own boss
		Be able to choose your own tasks
		Have power to make decisions
		Have authority
		Self-realization
		Realize one's dreams
To create something		
To take advantage of your creative needs		
Participate in the whole process		
To follow work tasks from A to Z		
Questionsrelated		I believe that my closest family think that I should pursue a career as self-employed.

with Subjective Norm	Kolvereid (1997)	I believe that my closest friends think that I should pursue a career as self-employed
		I believe that people who are important to me think that I should pursue a career as self-employed
Questions related with Perceived Behavioral Control	Kolvereid (1997)	For me being self-employed would be very easy/very difficult.
		If I wanted to, I could easily pursue a career as self-employed.
		As self-employed, how much control would you have over the situation
		The number of events outside my control which could prevent me from being self-employed are very low/very high
		If I pursue a career as self-employed, the chances of success would be very high
		If I pursue a career as self-employed, the chances of success would be very low

Analysis

The cronbach alpha values of the independent variables were calculated for reliability. Factor analyses revealed factor loadings of independent variables. Multiple regression analysis explored the effects of independent variables (attitudes toward employment, subjective norm and perceived behavioral control) on the dependent variable (entrepreneurial intention).

Findings

TABLE 2. KMO AND BARTLETT TEST RESULT FOR INDEPENDENT VARIABLES

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.895
Bartlett's Test of Sphericity	Approx. Chi-Square	24721.220
	df	2794
	Sig.	0.000

A KMO value which is 0.895 reveals that the data is appropriate to investigate and highlights the perfect correlation among the variables. Thus, the factor analysis can be conducted. The Bartlett's test result is 0.000 and confirms that the variables are suitable to conduct factor analysis. The independent variables' cronbach's alpha values are acceptable to test scale reliability. 50.4% of variance is explained in the factor analysis and it is good for validation.

TABLE 3. FACTOR ANALYSIS RESULTS OF INDEPENDENT VARIABLES

		Factor Loading	% Variance Explained	Cronbach α

Item No	Factor 1: Attitudes Toward Employment		38.9	0.812
29	Independence	0.886		
12	Not to have a stressful job	0.843		
32	Have power to make decisions	0.827		
33	Have authority	0.826		
36	To create something	0.813		
37	To take advantage of your creative needs	0.810		
35	Realize one's dreams	0.794		
34	Self-realization	0.779		
23	To keep a large proportion of the result	0.766		
22	To receive compensation based on merit	0.715		
25	To have an exciting job	0.707		
24	To have a challenging job	0.701		
27	To have a motivating job	0.690		
26	To have an interesting job	0.680		
39	To follow work tasks from A to Z	0.673		
10	To have leisure	0.666		
9	Not having to work long hours	0.625		
11	To have fixed working hours	0.617		
8	Job Stability	0.586		
38	Participate in the whole process	0.567		
17	Not taking on too much responsibility	0.560		
16	Avoid responsibility	0.543		
18	Avoid commitment	0.540		
13	Have a simple, not complicated job	0.537		
28	Freedom	0.526		
7	Job Security	0.505		
31	Be able to choose your own tasks	0.487		
30	To be your own boss	0.475		
21	Economic opportunity	0.473		
14	Participate in a social environment	0.465		
15	To be a member of a social "milieu"	0.458		
19	Have opportunity for career progress	0.453		
20	Promotion	0.413		
	Factor 2: Perceived Behavioral Control		7.30	0.711
41	If I wanted to, I could easily pursue a career as self-employed	0.790		
43	The number of events outside my control which could prevent me from being self-employed are very low/very high	0.700		
44	If I pursue a career as self-employed, the chances of success would be very high	0.686		
45	If I pursue a career as self-employed, the chances of success would be very low	0.606		
40	For me being self-employed would be very easy/very difficult	0.596		
42	As self-employed, how much control would you have over the situation	0.580		

	Factor 3: Subjective Norm		4.2	0.779
5	I believe that my closest friends think that I should pursue a career as self-employed	0.728		
6	I believe that people who are important to me think that I should pursue a career as self-employed	0.652		
4	I believe that my closest family thinks that I should pursue a career as self-employed	0.563		
	KMO= 0.895 P= 0.000		50.4	

TABLE 4. MULTIPLE REGRESSION ANALYSIS MODEL SUMMARY OF PLANNED ENTREPRENEURIAL BEHAVIOR AND ENTREPRENEURIAL INTENTION

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.712 ^a	0.507	0.501	1.15371	1.665

- a. Predictors: (Constant), Attitudes Toward Employment, Subjective Norm, Perceived Behavioral Control
b. Dependent Variable: Entrepreneurial Intention

The dimensions of the planned entrepreneurial behavior explain 50.7% of entrepreneurial intention. Perceived behavioral controls the most important dimension explaining entrepreneurial intention.

TABLE 5. MULTIPLE REGRESSION ANALYSIS COEFFICIENTS OF PLANNED ENTREPRENEURIAL BEHAVIOR AND ENTREPRENEURIAL INTENTION

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.194	0.122		8.447	0.000		
	Attitudes Toward Employment	0.147	0.038	0.047	3.681	0.022	0.589	1.223
	Subjective Norm (Attitude)	0.120	0.064	0.095	5.644	0.003	0.492	1.320
	Perceived Behavioral Control	0.281	0.032	0.114	4.914	0.004	0.410	1.181
F: 2.41 (p: 0.000)								

(p<0.05) Dependent Variable: Entrepreneurial Intention

Hypotheses:

H0a: Attitudes Toward Employment Does Not Affect Entrepreneurial Intention.

H1a: Attitudes Toward Employment Affects Entrepreneurial Intention.

p = 0.022 < 0.05 H0a is rejected.

H1a is accepted at 0.05 significance level. Thus, Attitudes Toward Employment Affects Entrepreneurial Intention. Attitudes Toward Employment has a positive effect on Entrepreneurial Intention.

H0b: Subjective Norm Does Not Affect Entrepreneurial Intention.

H1b: Subjective Norm Affects Entrepreneurial Intention.

$p = 0.003 < 0.05$ H0b is rejected.

H1b is accepted at 0.05 significance level. Thus, Subjective Norm Affects Entrepreneurial Intention. Subjective Norm has a positive effect on Entrepreneurial Intention.

H0c: Perceived Behavioral Control Does Not Affect Entrepreneurial Intention.

H1c: Perceived Behavioral Control Affects Entrepreneurial Intention.

$p = 0.004 < 0.05$ H0c is rejected.

H1c is accepted at 0.05 significance level. Thus, Perceived Behavioral Control Affects Entrepreneurial Intention. Perceived Behavioral Control has a positive effect on Entrepreneurial Intention.

Thus, H1 is accepted. Planned Entrepreneurial Behavior Affects Entrepreneurial Intention. Planned Entrepreneurial Behavior has a positive effect on Entrepreneurial Intention.

CONCLUSION

Attitudes toward employment, subjective norm and perceived behavioral control have positive effects on the entrepreneurial intention. Thus, it can be summarized that the planned entrepreneurial behavior has a positive effect on the entrepreneurial intention. Graduate students plan to be entrepreneurs and have entrepreneurial intentions. The perceived behavioral control is the most important dimension that explains the entrepreneurial intention. Graduate students consider that being an entrepreneur is easy. They feel that they can achieve to be entrepreneurs. They assume that they have resources and opportunities to establish their own businesses. Availability of these resources and opportunities arise power over the ability of graduate students to perform entrepreneurship. On the other hand, graduate students have positive evaluations for entrepreneurship. They feel that being an entrepreneur is attractive. They expect positive consequences if they become entrepreneurs. They feel that there is a high probability that positive things will happen in their lives if they choose entrepreneurship as their careers. They desire the consequences of being an entrepreneur in their lives. The reference groups of graduate students, people who are important for graduate students agree, approve and expect them to be entrepreneurs. Graduate students feel positive social pressure toward entrepreneurship and have motivation to conform their reference groups and social pressure. All these three factors lead graduate students to initiate entrepreneurial intentions, prefer self-employment and choose to be entrepreneurs as their career paths. This study revealed findings which supported Ajzen's TPB on the entrepreneurial intentions. This paper is expected to make contributions to academicians who examine factors which affect the entrepreneurial intention by conducting follow-up studies.

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A MIN-MAX NORMALIZED RANKING METHOD FOR FINDING THE MOST EFFICIENT DMUS IN DATA ENVELOPMENT ANALYSIS

Jae-Dong Hong, Industrial Engineering, South Carolina State University,
Orangeburg, SC 29117, 803-536-8861, jhong@scsu.edu

Ki-young Jeong, Engineering Management, University of Houston Clear Lake,
Houston, TX 77058, 281-283-3862, jeongk@uhcl.edu

ABSTRACT

This paper proposes a min-max normalized ranking method for finding the most efficient decision making units (DMUs) in Data Envelopment Analysis (DEA). The several cross efficiency methods have been developed as a DEA extension to rank efficient and inefficient DMUs with the main idea being to use DEA to do peer evaluation. But the serious weakness of these CE methods is that the efficiency scores may not be unique due to the non-uniqueness of the DEA optimal weights. Numerical examples are used to investigate the efficiency and robustness of the developed heuristic ranking method.

INTRODUCTION

Among many evaluation methods, the stochastic frontier approach (SFA) (parametric) and data envelopment analysis (DEA) (non-parametric) have been widely used. According to Grosskopf [7], the parametric approach has been developed mainly by economists, whereas non-parametric approach left to those in management science/operations research. DEA has become one of the most popular tools for measuring and improving operational processes. The popularity of DEA lies in its flexibility to incorporate the existence of multiple outputs and inputs easily without any assumption on the functional form. In fact, DEA evaluates the relative performance of a set of peer organizations called Decision Making Units (DMUs) and compare each DMU with only the best DMU(s). DEA is a mathematical programming based technique to evaluate the relative performance of organizations (Charnes, Cooper, and Rhodes [3]). The goal of DEA is to determine the relative efficiency of a system or DMU by comparing how well the DMU transforms its inputs into its outputs. Performance evaluation or measurement is a highlighted element of performance management considered as a core activity in managerial control function.

If DMUs produce a single output using a single input, the efficiency of the k th DMU, DMU_k , is defined as

$$\theta_k = y_k/x_k, \quad (1)$$

where y_k and x_k are the output produced and input used by DMU_k . If DMUs produce multiple outputs using multiple inputs, the efficiency of DMU_k is expressed as

$$\theta_k = \frac{\sum_{r=1}^s u_r y_{rk}}{\sum_{i=1}^m v_i x_{ik}}, \quad (2)$$

where

y_{rk} = amount of output r used by DMU_k ;
 x_{ik} = amount of input i used by DMU_k ;
 i = number of inputs used by the DMUs;
 r = number of outputs generated by the DMUs;
 u_r = coefficient or weight assigned by DEA to output r ;
 v_i = coefficient or weight assigned by DEA to input i .

In fact, the mathematical model of DEA, which is called as multiplier DEA (M-DEA) model, may be stated as

Objective Function:

$$\text{Maximize } \theta = \frac{\sum_{r=1}^s u_r y_{rk}}{\sum_{i=1}^m v_i x_{ik}} \quad (3)$$

(Maximize the efficiency rating θ for DMU_k)

This is subject to the constraint that when the same set of u and v coefficients (or weights) is applied to all other DMUs being compared, no DMU will be more than 100% efficient as follows:

$$DMU_j \quad \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1, \forall j \quad (4)$$

$$u_1, \dots, u_s > 0 \text{ and } v_1, \dots, v_m \geq 0,$$

The above model given by (3) and (4) can be transformed to the following linear programming problem, which is called a CRS (Constant Returns to Scale) M-DEA model:

$$\max z = \sum_{r=1}^s u_r y_{rk}, \quad (5)$$

Subject to

$$\sum_{i=1}^m v_i x_{ik} = 1, \quad (6)$$

$$\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0, j = 1, \dots, n, \quad (7)$$

$$u_r, v_i \geq 0, r = 1 \dots, s; i = 1 \dots, m$$

Let z^* denote the optimal value of the objective function corresponding to the optimal solution $(\mathbf{u}^*, \mathbf{v}^*)$. DMU_k is said to be efficient if $z^* = 1$. DEA models can be either input-oriented or output-

oriented, depending upon the rationale for conducting DEA. The model given by (5)-(7) is called an input-oriented CCR model and z^* is called CRS efficient score (ES).

The purpose of DEA is to empirically characterize the efficient frontier. If DMU_k lies on the efficient frontier, it is referred as an efficient unit, otherwise inefficient. Thus, multiple DMUs can lie on the efficient frontier due to the flexibility in selecting the input/output weights and its nature of self-evaluation. As a result, a high number of DMUs would be referred as an efficient unit, but DEA does not have any capability that could provide any ranking system among efficient DMUs consists of the efficient frontier.

To complement DEA's nature of self-evaluation, the cross efficiency (CE) evaluation method, suggested by Sexton, Silkman, and Hogan [10] and investigated by Doyle and Green [5], is used as a DEA-based ranking tool. The basic idea of the CE evaluation is to evaluate the overall efficiencies of the DMUs through both self-evaluation and peer-evaluations. It can usually provide a full ranking for the DMUs to be evaluated and eliminates unrealistic weight schemes without requiring the elicitation of weight restrictions from application area experts (see Anderson, Hollingsworth, and Inman [2]). But, as Doyle and Green [5] note in their paper, the optimal set of weights for a DMU is not unique, as is known. As a result, it is recommended that secondary goals be introduced in CE evaluation. There are two classical approaches: the first one is to minimize all CE evaluation scores of all DMUs, the second is to maximize these scores, which are known as the aggressive and benevolent model, respectively.

Some alternative models for CE evaluation method are DEA-Game Cross Efficiency (GCE) method that Liang, Wu, Cook, and Zhu [8] propose. In GCE method, the efficiency of DMU_j will be maximized, under the condition the efficiency of a given DMU_k , is not less than a given value of efficiency. In fact, many authors propose various CE based ranking methods (see Gavgani and Zohrehbandian [6] for the list of references). When a DMU under evaluation is not included in the reference set of the envelopment models, the resulting DEA models are called super-efficiency (SE) DEA models. Charnes, Haag, Jaska, and Semple [4] use SE model to study the sensitivity of the efficiency classifications and Anderson and Petersen [1] propose using the CRS SE model in ranking the efficient DMUs.

Another interesting method is the stratification of DMUs in DEA. Seiford and Zhu [9] modify the original DEA to the context-dependent DEA method, where DMUs are stratified into different efficiency levels. The context-dependent DEA method uses the following steps. Let $J^1 = \{DMU_j, j = 1, 2, \dots, n\}$ be the set of all n DMUs and iteratively define $J^{\ell+1} = J^\ell - E^\ell$, where E^ℓ consists of all the efficient DMUs on the ℓ^{th} level best practice frontier until J^ℓ becomes the empty set. The context dependent DEA method is characterized by an attractiveness measure (score), which enable us to select the best option, that is, the most attractive one.

All of these DEA-based evaluation methods require a linear programming (LP) formulation and implementation using a LP software and/or DEA software. In this paper, we propose a simple, efficient, and robust non-DEA-based (NDB) evaluation method for finding the most efficient DMU(s), which is in line with the principle of DEA methodology,

DEVELOPMENT OF NEW EVALUATION METHOD

Sortiros and Despotis [11] introduce the max-normalized (MXN) DEA model by dividing the input/output data by the maxima and show MXN-DEA model is structurally identical to the regular DEA (R-DEA) model with un-normalized data. In fact, both DEA models, MN-DEA and R-DEA, generate the same CE, GCE, and NSE scores for each DMU. Such a normalizing will prevent round-off errors that imbalanced data may lead to.

In this paper, we propose **the min-max normalized (MNXN) heuristic** where each input variable is divided by their minimum, whereas each output variable by the maximum. As is known, such normalizing will yield the same CRS ES and NSE scores that R-DEA model yields, but it will a different efficiency ratio given in (1). Suppose DMU_k is more efficient than DMU_g . If DMU_k dominates DMU_g , which means $x_k \leq x_g$ and $y_k \geq y_g$, then $\theta'_k = 1$ and $\theta'_g \leq \theta'_k$, where θ'_k denotes the efficiency of DMU_k under MNXN model. If not, the inequality, $\theta'_g \leq \theta'_k$ and $\theta_g/\theta_k = \theta'_g/\theta'_k$ still holds. To develop the proposed heuristics, let us start MNX normalizing the input and output variables as follows:

$$x'_{ik} = \frac{x_{ik}}{\text{Min}_j\{x_{ij}\}}, \forall i \text{ and } \forall j \quad (8)$$

$$y'_{rk} = \frac{y_{rk}}{\text{Max}_j\{y_{rj}\}}, \forall r \text{ and } \forall j. \quad (9)$$

It is quite obvious that the smaller the input is and the greater the output is, the greater the productivity is. The principle of the evaluation method proposed in this paper results from Equation (2). In this method, we evaluate the ratio of each output to the sum of inputs and select the best ration/productivity as the DEA method tried to give the best efficiency score for the DMU under evaluation. In fact, the optimal DEA multiplier or weight for inefficient input or output turns out to be zero to give the best efficiency score that it could give. Now, the productivity for the r^{th} output for DMU_k , P_{rk} , is given by

$$P_{rk} = \frac{y'_{rk}}{\sum_i^m x'_{ik}}, \quad (10)$$

Now, the efficiency score for DMU_k is expressed as

$$E'_k = \frac{\sum_{r=1}^s P_{rk}}{\text{Max}_j\{\sum_{r=1}^s P_{rj}\}}. \quad (11)$$

In E'_k given by (11), the overall efficiency of DMU_k is used in the calculation of the efficiency score.

We can see, from Equations (11), that the structure of the proposed method is same as ES method in DEA methodology. When Equation (11) of the method is compared with Equation (3) of ES method, we see that u_{rk}^* and v_{ik}^* in Equation (3) are replaced by $1/\text{Max}_j\{y_{rj}\}$ and $1/$

$Min_j\{x_{ij}\}$. In addition, multiplying the first part by the second part of Equation (11) ensures the constraints (7). We apply the proposed heuristic to the original data without min-max normalizing and call it a regular (R) heuristic.

As said before, the CE scores generated by DEA are not unique due to multiple optimal DEA weights/multiplier obtained from solving LP. But the efficiency score generated by the proposed MNXN heuristic, which does not requires LP formulation, is always unique. This method does not depend on the multiple optimal weights, but on the ratio of output to sum of the inputs. To evaluate the heuristics, we use two numerical examples which can be found in well-known DEA related literature.

NUMERICAL EXAMPLES

We consider the numerical example illustrated by Liang, et al. [8], where there are five DMUs, with three inputs and two outputs as shown in Table 1a. Using DEA Frontier software created by Zhu (www.deafontier.net), we present and rank based on the results of CE, GCE, and NSE scores generated by DEA methodology in Table 1a. We also present two efficiency scores, by the R heuristic with the original input and output data and MNXN heuristic. As shown in Table 1a, DMU_3 and DMU_2 possess a perfect efficiency score (ES) of one. In fact, all the scores generated by DEA methodology and the scores of MNXN and R heuristics consistently indicate that DMU_3 and DMU_2 would get ranked first and second among them. Interestingly, both heuristics rank DMU_1 ahead of DMU_4 , whereas all other DEA-based methods rank the other way. Indeed, DMU_4 has a higher CRS ES of 0.857 than DMU_1 with 0.685.

Table 1a. Comparison of Cross Efficient Scores and Rankings for Five DMUs

DEA	DMU	Inputs (X_1, X_2, X_3) Outputs (Y_1, Y_2)	CRS ES	DEA Frontier			Heuristic
				CE	GCE	SE	
R	1	(7, 7, 7) (4, 4)	0.685	0.545 [5]	0.638 [5]	0.685 [5]	0.476 [4]
	2	(5, 9, 7) (7, 7)	1.000	0.862 [2]	0.976 [2]	1.120 [2]	0.833 [2]
	3	(4, 6, 5) (5, 7)	1.000	1.000 [1]	1.000 [1]	1.500 [1]	1.000 [1]
	4	(5, 9, 8) (6, 2)	0.857	0.576 [3]	0.798 [3]	0.857 [3]	0.454 [5]
	5	(6, 8, 5) (3, 6)	0.857	0.561 [4]	0.666 [4]	0.857 [3]	0.592 [3]
MNXN	1	(1.75, 1.16, 1.4) (.571, .571)	0.685	0.447 [5]	0.638 [5]	0.685 [5]	0.463 [4]
	2	(1.25, 1.5, 1.4) (1, 1)	1.000	0.889 [2]	0.976 [2]	1.120 [2]	0.843 [2]
	3	(1, 1, 1) (.714, 1)	1.000	0.978 [1]	1.000 [1]	1.500 [1]	1.000 [1]

	4	(1.25, 1.5, 1.6) (.857, .285)	0.857	0.550 [3]	0.798 [3]	0.857 [3]	0.459 [5]
	5	(1.5, 1.33, 1) (.428,.857)	0.857	0.540 [4]	0.667 [4]	0.857 [3]	0.587 [3]

[.] represents the corresponding ranking.

Thus, to see the consistency of the ranks of each evaluation method, we use stratification of DMUs and classify all DMUs into the two levels. As expected, DMU_3 and DMU_2 are identified as DMUs on the first level, E^1 , so we remove DMU_3 and DMU_2 from the list, compute each score and resulting ranks for the DMUs on the second level, E^2 , and present them in Table 1b. From Table 1b, we see that DMU_5 would get ranked No. 1 in the second level and that the CE scores with MNXN data rank DMU_1 ahead of DMU_4 , conflicting with the results of Table 1a. The scores and rankings generated by the heuristics consistently rank DMU_5 , DMU_4 , and DMU_1 in the same order that they rank them in Table 1a. Note that all three DMUs, DMU_1 , DMU_4 , and DMU_5 have a perfect efficiency score (ES) of one (1).

Now, we remove DMU_5 from the second level, compute the scores for the remaining two DMUs, DMU_1 and DMU_4 , and present them in Table 1c. Interestingly, six (6) out of eight (8) cases indicate that DMU_1 would be more efficient than DMU_4 , whereas only two (2) cases suggest that both DMUs be same in terms of efficiency. From the analysis, we rank $\{DMU_3, DMU_2, DMU_5, DMU_1, DMU_4\}$ in this order, the same rank order that both heuristics initially suggest in Table 1a. The various scores generated by DEA-based methods find the two top DMUs, but do not initially find the reasonable rankings for the rest of DMUs. As well known, the scores generated by DEA methodology depend upon the DMUs in the reference set of the DEA models. Thus, the rankings produced by the DEA-based evaluation methods usually are not consistent.

Table 1b. Comparison of Cross Efficient Scores for DMU_1 , DMU_4 , and DMU_5

DEA	DMU	Inputs (X_1, X_2, X_3) Outputs (Y_1, Y_2)	CRS ES	DEAFrontier			Heuristic
				CE	GCE	SE	
R	1	(7, 7, 7) (4, 4)	1.000	0.873 [1]	1.000 [1]	0.535 [3]	0.804 [2]
	4	(5, 9, 8) (6, 2)	1.000	0.685 [3]	1.000 [1]	1.000 [1]	0.767 [3]
	5	(6, 8, 5) (3, 6)	1.000	0.854 [2]	1.000 [1]	1.000 [1]	1.000 [1]
MNXN	1	(4.67, 5.25, 7) (0.67, 1)	1.000	0.746 [2]	1.000 [1]	0.535 [3]	0.781 [2]
	4	(3.33, 6.75, 8) (1, 0.5)	1.000	0.736 [3]	1.000 [1]	1.000 [1]	0.764 [3]
	5	(1, 1, 1) (0.07, 0.21)	1.000	0.933 [1]	1.000 [1]	1.000 [1]	1.000 [1]

Table 1c. Comparison of Cross Efficient Scores for DMU_1 vs. DMU_4

DEA	DMU	Inputs (X_1, X_2, X_3) Outputs (Y_1, Y_2)	CRS ES	DEAFrontier			Heuristic
				CE	GCE	SE	
R	1	(7, 7, 7) (4, 4)	1.000	0.928 [1]	1.000 [1]	1.000 [1]	1.000 [1]
	4	(5, 9, 8) (6, 2)	1.000	0.694 [2]	1.000 [1]	0.816 [2]	0.954 [2]
MNXN	1	(1.4, 1, 1,) (0.667, 1)	1.000	0.928 [1]	1.000 [1]	1.000 [1]	1.000 [1]
	4	(1, 1.28, 1.14) (1, 0.5)	1.000	0.850 [2]	1.000 [1]	0.816 [2]	0.892 [2]

In this example, we consider only five DMUs in the list and easily find the rankings of DMUs. It would be not so easy if there are many DMUs in the list, especially when the evaluation methods produce the non-consistent or conflicting rankings. In the previous example, DMU_3 and DMU_2 belong to the first level, E^1 , and the rest DMUs the second level, E^2 . The attractiveness (AT) scores of DMU_3 and DMU_2 turn out to be 1.975 and 1.82, respectively, which make DMU_3 get ranked number one ahead of DMU_2 ranked number two. We will use attractiveness (AT) scores for the next example consisting of 17 DMUs.

To investigate the performance of the proposed MNXN heuristic method further, we use the data of Zhu [12] that are presented in Table 3, where there are seventeen laptops two inputs: (i) price (\$) and (ii) weight (lbs), and three outputs: (i) average battery life (hours), (ii) ram size (gb), and HDD capacity (gb).

In Table 4, we present all the scores generated by DEA-based evaluation methods and the heuristics. We observe that DMU_7 gets the top ranking four times, whereas DMU_5 and DMU_9 rank first once. For ranking number 2, DMU_9 gets three times, DMU_6 and DMU_7 get once each. From this observation, we may rank DMU_7 first and DMU_9 second, as the MNXN heuristic suggests. Now, we use stratification of DMUs and classify all DMUs into the four levels. The scores and corresponding rankings for DMUs are reported in Tables 5, 6, 7, and 8, for each level.

We identify seven DMUs on the first level, E^1 , in Table 5 and observe that DMU_7 and DMU_9 get the top ranking four times and two times, respectively. Considering the various rankings given to DMUs, we may list $\{DMU_7, DMU_9, DMU_8, DMU_6, DMU_{14}, DMU_{16}, DMU_5\}$ in this order, as both of the average rankings and the MNXN heuristic indicate. Note that MNXN heuristic ranks the seven DMUs on the first level in the same order as in Table 4. We observe that the MNXN heuristic would generate better consistent rankings than the R heuristic. In fact, the MNXN heuristic also generates the consistent and reasonable rankings for the DMUs on the levels 2 and 3, compared with rankings made by the DEA-based evaluation methods. But for the DMUs on the last level, DMU_3 and DMU_{13} , which are considered the least efficient DMUs, no DMU receives the consistent rankings regardless of the evaluation methods or the heuristics. So we may give both DMUs the lowest rank. Now, based on the analysis of the rankings in Tables 5 through 8, we may rank $\{DMU_7, DMU_9, DMU_8, DMU_6, DMU_{14}, DMU_{16}, DMU_5, DMU_2, DMU_{10}, DMU_{15}, DMU_{11}, DMU_4, DMU_1, DMU_{12}, DMU_{17}, DMU_3/DMU_{13}\}$ in this order. As shown in

these two numerical examples, we see the MNXN heuristic performs well and would provide very robust rankings for DMUs in DEA.

Table 3. Seventeen (17) Laptops for Business Travel

DMU	Brand (model)	Price (\$)	Weight (lbs)	Average Battery Life (Hours)	RAM (gb)	HDD capacity (gb)
1	HP (11-E010nr)	414.99	3.4	5.0	4	500
2	Acer (V5-131)	339.98	3.3	6.5	4	500
3	Acer (AS1410)	449.99	3.1	6.0	2	250
4	Lenovo (X100e)	498.88	3.3	7.5	1	250
5	Acer (V5-171)	683.67	3.0	5.0	6	500
6	ASUS (X200CA)	299.99	2.6	5.0	2	500
7	ASUS (Q200E)	399.99	3.1	11.0	4	500
8	Lenovo (IdealPad S210)	279.99	3.1	4.0	4	500
9	Dell (Inspiron 11)	279.99	3.1	8.0	2	500
10	Acer (S3-391-6046)	405.00	3.0	3.0	4	320
11	Lenovo (IdealPad Yoga13)	1029.00	3.3	8.0	4	500
12	Gateway (LT41PO4u)	338.45	2.4	5.0	2	320
13	Samsung (Series 5)	799.99	3.7	5.5	4	500
14	ASUS (1015E)	259.00	2.8	7.5	2	320
15	ASUS (X202E)	669.58	3.0	4.5	4	500
16	Toshiba (T115D)	300.00	3.5	9.0	2	250
17	Sony (YB Series)	340.00	3.2	5.45	2	320

Table 4. Comparison of CE Scores and Rankings

DMU	CRSES	DEAFrontier						Heuristic	
		CE		GCE		SE			
		R	MNXN	R	MNXN	R	MNXN	R	MNXN
1	0.881	0.700 [7]	0.723 [8]	0.841 [8]	0.881 [11]	0.675 [7]	0.747 [7]		
2	0.950	0.828 [4]	0.822 [4]	0.926 [6]	0.950 [8]	0.825 [4]	0.893 [4]		
3	0.545	0.452 [16]	0.485 [16]	0.518 [17]	0.545 [17]	0.316 [15]	0.484 [15]		
4	0.640	0.410 [17]	0.457 [17]	0.537 [16]	0.640 [15]	0.286 [16]	0.434 [17]		
5	1.000	0.687 [8]	0.780 [6]	0.928 [5]	1.500 [1]	0.413 [13]	0.671 [9]		
6	1.000	0.809 [5]	0.860 [3]	0.971 [2]	1.185 [5]	0.930 [3]	0.848 [5]		
7	1.000	0.924 [1]	0.969 [1]	1.000 [1]	1.403 [2]	0.709 [5]	1.000 [1]		
8	1.000	0.851 [3]	0.814 [5]	0.969 [3]	1.214 [4]	0.996 [2]	0.910 [3]		
9	1.000	0.870 [2]	0.869 [2]	0.963 [4]	1.231 [3]	1.000 [1]	0.924 [2]		
10	0.877	0.554 [12]	0.563 [14]	0.752 [12]	0.877 [12]	0.445 [11]	0.597 [11]		

11	0.894	0.547 [14]	0.674 [11]	0.782 [11]	0.894 [10]	0.275 [17]	0.476 [16]
12	0.761	0.624 [9]	0.677 [10]	0.737 [13]	0.761 [14]	0.533 [8]	0.658 [10]
13	0.764	0.512 [15]	0.597 [12]	0.691 [14]	0.764 [13]	0.352 [14]	0.498 [14]
14	1.000	0.750 [6]	0.741 [7]	0.870 [7]	1.002 [7]	0.699 [6]	0.812 [6]
15	0.933	0.600 [11]	0.705 [9]	0.834 [9]	0.933 [9]	0.420 [12]	0.576 [13]
16	1.000	0.615 [10]	0.593 [13]	0.785 [10]	1.036 [6]	0.477 [10]	0.671 [8]
17	0.618	0.548 [13]	0.558 [15]	0.603 [15]	0.618 [16]	0.530 [9]	0.590 [12]

Table 5. Comparison of DMUs in Level 1

DMU	CRSES	DEAFrontier								Heuristic	
		CE		GCE		SE		AT			
		R	MNXN	R	MNXN	R	MNXN	R	MNXN	R	MNXN
5	1.000	0.606 [7]	0.722 [6]	0.835 [7]		1.550 [1]		1.683 [7]		0.413 [7]	0.664 [7]
6	1.000	0.656 [6]	0.890 [3]	0.931 [5]		1.185 [5]		1.768 [6]		0.930 [3]	0.850 [4]
7	1.000	0.926 [1]	0.956 [1]	1.000 [1]		1.408 [3]		1.900 [2]		0.709 [4]	1.000 [1]
8	1.000	0.755 [4]	0.793 [4]	0.994 [2]		1.428 [2]		1.851 [5]		0.996 [2]	0.916 [3]
9	1.000	0.817 [2]	0.918 [2]	0.992 [3]		1.231 [4]		2.108 [1]		1.000 [1]	0.930 [2]
14	1.000	0.792 [3]	0.768 [5]	0.934 [4]		1.002 [7]		1.844 [7]		0.698 [5]	0.817 [5]
16	1.000	0.730 [5]	0.621 [7]	0.885 [6]		1.036 [6]		1.896 [4]		0.477 [6]	0.676 [6]

Table 6. Comparison of DMUs in Level 2

DMU	CRSES	DEAFrontier								Heuristic	
		CE		GCE		SE		AT			
		R	MNXN	R	MNXN	R	MNXN	R	MNXN	R	MNXN
2	1.000	0.992 [1]	0.974 [1]	1.000 [1]		2.050 [1]		1.909 [1]		1.000 [1]	1.000 [1]
4	1.000	0.526 [5]	0.520 [5]	0.831 [5]		1.095 [4]		1.133 [5]		0.346 [4]	0.490 [5]
10	1.000	0.665 [4]	0.656 [4]	0.929 [4]		1.071 [5]		1.554 [2]		0.538 [2]	0.686 [2]
11	1.000	0.705 [3]	0.716 [3]	1.000 [1]		1.191 [2]		1.349 [3]		0.333 [5]	0.543 [4]
15	1.000	0.771 [2]	0.771 [2]	0.971 [3]		1.100 [3]		1.183 [4]		0.508 [3]	0.644 [3]

Table 7. Comparison of DMUs in Level 3

DMU	CRSES	DEAFrontier								Heuristic	
		CE		GCE		SE		AT			
		R	MNXN	R	MNXN	R	MNXN	R	MNXN	R	MNXN
1	1.000	0.927 [2]	0.829 [3]	1.000 [1]		1.631 [1]		1.927 [1]		1.000 [1]	1.000 [1]

12	1.000	0.968 [1]	0.968 [1]	1.000 [1]	1.248 [2]	1.580 [3]	0.788 [2]	0.931 [2]
17	1.000	0.815 [3]	0.832 [2]	1.000 [1]	1.085 [3]	1.593 [2]	0.784 [3]	0.829 [3]

Table 8. Comparison of DMUs in Level 4

D M U	CRS ES	DEA Frontier								Heuristic	
		CE		GCE		SE		AT			
		R	MNXN	R	MNXN	R	MNXN	R	MNXN	R	MNXN
3	1.000	0.944 [2]	0.944 [1]	1.000 [1]		1.939 [1]		0.789 [2]		0.898 [2]	1.000 [1]
13	1.000	1.000 [1]	0.757 [2]	1.000 [1]		1.675 [2]		0.853 [1]		1.000 [1]	0.985 [2]

SUMMARY AND CONCLUSION

In this paper, we propose the **min-max normalized (MNXN) heuristic** where each input variable is divided by the minimum, whereas each output variable by the maximum and develop an efficient heuristic of ranking DMUs in Data Envelopment Analysis (DEA). This proposed method is based upon the basic definition of the efficiency and provide robust rankings for the DMU under evaluation, whereas the ranks provided by DEA-based various cross efficient evaluation methods are not consistent, depending on the DMUs to be evaluated. Not like other CE-based ranking methods proposed by many researchers, the proposed MNXN method does not require any LP formulation/implementation. Consequently, the result does not depend upon LP software or DEA software. From the analysis, we observe that if the rankings decided by the various CE scores are not consistent, it would be difficult to give them absolute rankings. As shown in the numerical examples, rankings generated by DEA-related CE scores greatly depend upon the DMUs under evaluation. The MNXN heuristic generates more robust and consistent rankings and is less affected by the DMUs under evaluation than DEA-based evaluation methods. Thus, along with various CE evaluation methods in DEA methodology, the proposed heuristic method could be used a valuable tool of ranking DMUs under evaluation in DEA.

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Managing aircraft maintenance resource allocations using DEA

James Gibson, Texas Tech University

Abstract

In day-to-day operations, meeting an aviation flight schedule is a balance between the inelastic resources of the maintenance department and the elastic demands of the operations department. The DEA methodology is applied to maintenance resource allocation to determine the importance of the resource factors relative to the aircraft models in the operator's fleet. The efficiency ratings are used to identify resource constraints and develop an aircraft readiness metric for use in aircraft assignment and scheduling.

Industry-Specific Sources of Big Data Research Opportunities and Challenges:
The Agency for Healthcare Research and Quality Data Bases and Software Tools

William Johnson Miller
Christopher M. Lowery
College of Business, Georgia College & State University
Department of Management
Milledgeville, GA 31061
(william.miller@gcsu.edu)

Andrew T. Sumner
College of Business, Georgia State University
Institute of Health Administration
Atlanta, GA 30303

For researchers interested in evaluating industry-wide or “macro-level” organizational behavior issues, obtaining data can be much more challenging, than for “micro-level” researchers who can rely on obtaining the cooperation of a few organizations, surveying several employees. In this era of “Big Data,” these researchers more than ever before need to take advantage of existing publicly available data bases to help test important macro-level research questions. This study focuses on one set of such data bases from the hospital industry, illustrating both the opportunities and challenges in seeking to perform research over several years.

In today’s world of “Big Data,” there is perhaps no industry which has made available huge data bases to researchers than the healthcare industry. One of the primary sources of these data bases is the Agency for Healthcare Research (AHRQ) which is part of the U.S. Department of Health & Human Services. Through the Healthcare Cost and Utilization Project (HCUP, <http://www.hcup-us.ahrq.gov/>), researchers can acquire millions of healthcare claims each containing hundreds of data elements. These data bases include hospital in-patient and out-patient claims. Beyond providing access to these data bases, HCUP has also developed several software tools which enable researchers to assess various aspects of quality, including prevention quality indicators, inpatient quality indicators, patient safety indicators, and pediatric quality indicators.

Over the last decade, the combination of such data bases and such tools have provided an excellent opportunity for these researchers to test models assessing the relationship between organizational structure and quality outcomes. Unfortunately, the healthcare industry is a dynamic one in which change is a constant. As a result, the process of coding claims, delivering care, and administering a program as broad as HCUP has resulted in many updates of the Quality Indicator tools. For example since 2007, there have been over 10 updates of the Patient Safety Indicator tool, some with only minor programming changes and some with the addition and exclusion of indicators. According to the administrators at HCUP the version of the tool used should always be the most recent, but for purposes of consistency it is more difficult for researchers to continually change tools. This study will assess the impact of this dynamic situation by comparing the results produced from the original 2007 tool with the most recent 2015 version. Results will inform researchers in the future when dealing with similar data base issues.

Improving Quantitative and Statistical Instruction

Session chair & organizer:

Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Presenters and Panelists:

Ping Wang, James Madison University, wangpx@jmu.edu

Robin Snyder, Robin Snyder, robin@robinsnyder.com

Joe Van Matre, University of Alabama Birmingham, jgv@uab.edu

Steve Silver, The Citadel, silvers@citadel.edu

Abstract: Panelists address a variety of potential instructional improvements that include: considering the importance of student attitude for student success, ways to help students internalize and take ownership of statistical topics being taught, focusing applications on the student's discipline with a discussion of teaching to a finance audience, and using internet based technology to assist with instruction. Audience members are encouraged to join in the discussion of these topics.

Session Description:

Ping Wang will address how much student attitude is related to course outcome. He will present data that was obtained for the purpose of determining if there is a relationship between student attitude and course outcome. If student outcome is related to student attitude, then consideration needs to be given to deciding if class instruction should address student attitude as well as academic content.

Robin Snyder will present a series of short problems for concepts in probability and statistics that operationalize real problems so students can internalize the solution process and use it to solve similar problems. To internalize something is to make it part of oneself such that it becomes easy to work with and reason about that something. To operationalize something is to make it real in some form. Internalizing concepts in business probability and statistics can be facilitated by operationalizing the concepts in some real form such that one can relate that real form to other similar problems.

Joe Van Matre will share his experiences and what he learned from teaching a quantitative analysis in finance course for finance majors.

Steve Silver will briefly examine approaches educators and educational institutions at all levels are exploiting or considering to use technology to improve the delivery of instruction to their students. Then he will demonstrate how online technology can be used to create a "Course in a Box" that can be used in a wide variety of educational settings.

Panel Discussion Proposal SEDSI 2016: Millennials in Our Midst

Submitted by: Donna M. Schaeffer, Cynthia Knott and Charley Tichenor
Donna.schaeffer@marymount.edu, Cynthia.knott@marymount.edu,
Charles.tichenor@marymount.edu

We plan to facilitate a conversation about what a millennial is and what different generations may have in common. Some ideas about millennials:

Millennials like to chase 'bright, shiny objects', in a school/work context and outside it. How do we motivate a millennial to participate, how do we help to retain and develop them within the University?

Millennials are known by some as the 'trophy' generation, where they are used to being winners. When reality hits in the University context, and they are no longer winning at everything, or winning because they show their best efforts. This takes some getting-used-to for them. How do we sandwich criticism and help them embrace feedback as learning opportunities while continuing to stroke their egos?

Millennials creatively problem solve collaboratively with others. They want to know the why of things, and want to see the metrics and the data. We need to avoid telling them what to do and how to do it. How do we best design class assignments? How do we convey relevance and impact?

Millennials love technology and devices, and communicate and connect differently than those of other generations. So accept that they communicate differently, but how do we help them do what they do in a professional manner? When a millennials' love-of-devices makes them appear unfocused and un-engaged in the classroom, how do we help them understand how he/she is coming across and to make different choices?

Millennials may be more experienced and less fearful of trying new things, especially around technology, so we need to use this to our advantage. They also have an entrepreneurial streak. Millennials love to continuously learn and grown. So, how do we challenge them?

Millennials tell it the way it is – they are clear and transparent and direct in general. This is great, but how do we provide lessons in strategy or tact, so they learn to be respectful?

Resources:

Steve Bilbo, Senior Program Manager and Engineer, [You Sound OLD! – Stop Saying This at Work](#) (what boomers need to stop saying) and [You Sound Too Young!! – Stop Saying This at Work](#) (what millennials need to stop saying)

Daniel Pink, [Drive: The Surprising Truth About What Motivates Us](#)

Lynn Lancaster, David Stillman, [The M-Factor: How the Millennial Generation Is Rocking the Workplace](#)

INTERNATIONAL BUSINESS STRATEGY - INNOVATION AND ALLIANCES FOR MARKET SHARE - LESSONS FROM THE HISTORY OF AMERICAN MOTORS CORPORATION

Christopher Ziemnowicz, School of Business, University of North Carolina at Pembroke
1 University Drive, Pembroke, NC 28372-1510, ziemnow@uncp.edu 910-521-6286

John E. Spillan, School of Business, University of North Carolina at Pembroke
1 University Drive, Pembroke, NC 28372-1510, john.spillan@uncp.edu 910-775-4357

ABSTRACT

The automobile industry has faced pressing challenges and turbulent transformations almost throughout the past hundred years of its history. Managing for cost containment, innovation, and business survival are only a few of the top of the agenda for industry decision-makers over the years. With a constant battle for market share and profitability, new product designs, market positioning, niche markets, outsourcing, as well as various alliances have been just a few of the standard strategic options for automakers.

The focus of this paper is on an organization that was born as a result of a strategic vision that merged two independent automakers, Nash-Kelvinator and Hudson Motors, in the early 1950s as a consequence of a brutal price war between the leading producers, Ford and General Motors. This historical review examines the strategic decisions taken over the years by the top managers at American Motors Corporation (AMC) that only held a small market share compared to its much larger competitors. Nevertheless, AMC introduced innovative vehicles, developed new market segments, and expanded its international ventures even under the toughest environments. This paper outlines some of the directions that AMC managers made as the company responded to internal and external environmental factors from its origin in 1954 to its buyout by Chrysler in 1987. It focuses on the automaker's innovations and alliances as strategies to hold on to its small market share.

The history of AMC reveals some predictable patterns of management decision-making, and the analysis reveals that business history repeats itself. Even with a carefully crafted strategic vision, AMC's history demonstrates that strategic planning is not a linear function. Knowledge of AMC's history and experiences may provide current decision-makers with greater insight into developing business strategies to make a difference and change the future in this industry. This enhances awareness of some of the decision-making problems within the competitive environment in the auto industry. This review may serve to provide some lessons for all decision-makers in using innovative approaches, as well as the reasons of some of the results gained from establishing joint ventures and other alliances.

EXPLORATORY VALIDATION OF THE WOMEN AS MANAGERS SCALE WITH A SAMPLE OF CHINESE COLLEGE STUDENTS

Tope Adeyemi-Bello, Department of Management, College of Business, East Carolina University, Greenville, NC 27858, 252-328-4856, bellot@ecu.edu

Cody Chullen, Department of Management, College of Business, East Carolina University, Greenville, NC 27858, 252-737-4608, chullenc@ecu.edu

Xiao-Yu Xi, School of International Pharmaceutical Business, Jingguanwen Building, 639 Longmian Road, Jiangning District, China Pharmaceutical University, Nanjing, Jiangsu Province, China (86-13-852-29-7573, cpuxixiaoyu@163.com)

ABSTRACT

A number of studies have focused on the attitude toward women managers across many nations. A few of these studies have focused on the attitude toward women managers in China. The survey instrument that was used in these studies has a cultural component that can only be unearthed by validation on a national basis. Since most of the studies using the Women As Managers scale (WAMs) have been comparative in nature, the implication heretofore is that no cultural variation is observable in the use of the WAMs. Therefore, the focus of this research study was not only to highlight the gender differences in the attitude toward women managers in China, but additional analysis was also undertaken to explore the 'universalistic' and 'particularistic' components of the Women As Managers' scale (WAMs). Consistent with previous studies, our results indicate that Chinese women have more positive attitude toward women managers than their male counterparts but future researchers may need to validate the WAMs scale before using it in cross-cultural studies.

INTRODUCTION

Hofstede's model was developed to aid in understanding the relationship between cultural values and organizational behavior [16]. The goal of the research was to provide an explanation for the way people behave in different cultures. The study used a sample of over one hundred thousand people in more than fifty countries. While Hofstede's framework has been used to explain the variations in the structuring of organizations and the differences in decision making styles across cultures, it can also be useful in explaining the plethora of attitudes toward women managers. In essence, the various dimensions that Hofstede found in his study may be useful in explaining why some nations have a higher representation of females in their managerial ranks than others. Hofstede proposed four value dimensions in his original research. They are power distance, uncertainty avoidance, individualism, and masculinity.

Attitude toward women managers has been the focus of a number of studies. Samples have been drawn from many nations including the United States, Poland, Chile, Nigeria, and Netherlands (1). A few of these studies have also focused on China but primarily on a comparative basis (e.g., 19). While comparative studies have significant value, a study

focused primarily on an individual nation allows cross-cultural researchers to further explore the intricacies of the gender differences within each nation using the WAMs scale. This type of study has been previously done for the United States and Nigeria for example. Both countries are the largest economies on their respective continents. Given the significance of the Chinese economy in Asia, the current study hopes to further explore the important peculiarities in the gender differences in the attitude toward women managers in China and the potentially unique characteristics of the WAMs scale within this nation (11).

Traditionally, the differences between men and women have been used as excuses to exclude females from certain jobs (3). Occupational segregation is the term that has been used to describe the heavy concentrations of men and women into different jobs. For example, occupational segregation supposedly explains why men dominate managerial positions while women are often consigned to other occupations with lower pay, status, and responsibility. Specifically, Fierman (10) reported that only nineteen of more than four thousand people (less than half of one per cent) listed as the highest paid officers and directors of the largest eight hundred public U.S. companies were women.

The number of women in management positions is influenced by the perceptions of men who have traditionally dominated the upper echelons of business organizations (12). An argument can be made and supported by considerable research that the discouraging plight of women in management is a result of negative stereotypes held about them (13, 14). Schein (27, 28) reported that both male and female middle managers perceived that successful managers in general possessed characteristics ascribed more to men than to women. These characteristics include among others aggression, dominance (5), and achievement orientation (2). In fact, the characteristics (e.g., co-operative and communicative) that have often been ascribed to women are considered 'unmanagerial' (e.g., 24, 25). It is therefore not surprising that women represent a very low percentage of top executive positions and are often not considered for expatriate assignments (2).

While sex role stereotyping of managerial work can not only result in the perception that females are less capable or qualified than males to hold managerial positions, it may also hinder the entry of women into the upper hierarchies of business organizations. Schein (29) concluded that such stereotyping tends to reduce the opportunities for females to advance within business organizations even though the perceived sex differences do not actually exist (8).

A specific area of study within the general attitude toward women's role is that pertaining to women managers in particular. Since managerial ranks have been dominated by men historically, the present study attempts to investigate the differences in attitude toward women managers in China while also exploring the uniqueness of the WAMs scale to a Chinese sample.

A number of studies have historically been done to assess the attitudes of college students toward women in general. The landmark study was done by Epstein and Bronzaft in 1972 [9]. They found that first year college students at the time of their study expected to become more career oriented rather than the 'traditional' housewife. Throughout the

1980s, a number of research studies also found support for more positive attitudes toward women in traditionally male-dominated occupations including the presidency of the United States (4). In addition, a national survey of first year college students conducted in 1993 found increased support for women to be less involved in traditional roles like child rearing and house-keeping [15].

Over the years, various factors have been hypothesized as indicators and/or moderators of the attitudes toward women. These include prevailing attitudes in a particular nation and the historic and traditional roles within a culture (30). Age cohorts have also been found to influence attitudes toward women's roles in society. Dambrot, Papp, and Whitmore (7), for example, found that older men and women are more conservative in their attitudes toward women's role in society than their younger counterparts.

Regionalism has also been used as an explanatory factor for the variation in attitudes toward women in the United States. Research studies on a state by state basis for example found that students at the University of Washington in Seattle had more liberal attitudes toward women's role in society than a comparable sample of students from the state of Texas (20, 22). In general, there are indications by a number of studies that men and women in the Southern part of the United States may have more conservative attitudes toward the roles of women (17). For example, it is more common for men and women from the Southern part of the United States to have more negative attitude toward the employment of married women (26). Nevertheless, one common theme for contemporary research studies that have been done in the United States indicates a more egalitarian attitude toward the role of women in society over the years. The use of college students in the current study is therefore consistent with previous researchers who view this population as 'future managers'.

METHOD

The questionnaire used was the WAMS or Women as Managers Scale [23]. The Women as Managers Scale was chosen because it has been used extensively in previous studies that have attempted to measure attitudes toward women managers, particularly in the United States. However, it has also been used to investigate differences in attitudes toward women as managers across various nations including professionals in Nigeria (1) and Chile (6). The Women as Managers Scale consists of 21 statements about women as managers (e.g. "It is acceptable for women to compete with men for top executive positions"). Respondents indicate how strongly they agree or disagree with each item on a 7-point scale from "strongly agree" to "strongly disagree."

Mean scores ranged from a low of 3.74 to a high of 4.60 for men. For the women, the lowest mean score was 3.4 to the highest of 6.28. The psychometric properties of the scale, done primarily with US samples, have been detailed in Peters, et al. (23), Terborg, Peters, Ilgen & Smith (31) presented evidence for the construct validity of the scale, and support for its reliability is provided by Ilgen and Moore (18).

In order to successfully use the Women As Managers scale in China, we had to translate it to Chinese. The questionnaire was originally translated from English to Chinese by one of

the co-authors in this study. To validate the translation, we solicited assistance from another Chinese professor in the College of Business of a regional university in the United States to translate it back into English. This allowed us to identify questionnaire items that may pose difficulties for our Chinese sample. We asked the Chinese professor in the US to make the modifications that were necessary on those potentially problematic questions identified through the back-translation given the English language-based original. Subsequently, we asked a Chinese professor in the UK to translate the revised questionnaire in Chinese back into English. After this iteration, we were satisfied with the correspondence between the English and Chinese-based versions of the questionnaire.

Our sample consisted of upper-level business students from a national university in Nanjing. There were 470 respondents with 430 useable responses (215 males and 215 females). Mean scores were calculated and rank ordered for each of the 21 questionnaire items by gender. Furthermore, using two-tailed t-tests, we looked for significant differences in scores on individual questionnaire items for males and females (Table 1).

RESULTS

In this study, significant differences were observed for both men and women on all scale items (Table 1). The significance ranged from a low of $p < .05$ to $p < .001$. Women scored higher than men on all scale items except one. On the first scale item that 'It is less desirable for women than men to have a job that requires responsibility', males scored higher than females ($p < .01$). The most significant difference in mean scores was observed for scale item number ten that 'It is acceptable for women to compete with men for top executive positions'. The implication is that this is the most significant area of contention between men and women in this sample at the $p < .001$ level. Interestingly, of the top five highest ranked scale items for women, there was agreement in the male sub population for four of them.

Factor analysis of the scale items revealed five factors (Table 2). Even though four of the five factors showed statistically significant differences for both men and women, only the first factor explained more than 10 percent of the variance (Table 3). The first factor is also the only one with a standard deviation less than one (Table 4) for both men and women (indicating more internal consistency). The top five highest ranked scale items for both men and women were included in the first factor. Eleven of the twenty one scale items loaded on Factor 1. These were questionnaire items 2, 4, 5, 7, 8, 9, 10, 11, 19, 20, and 21. Factor 1 explained almost 27 percent of the variance in the attitude toward women managers in our sample (Table 3).

CONCLUSION AND COMPARISON TO PREVIOUS RESEARCH

There are two previous that have used the Women as Managers scale on Chinese samples [30] and Javalgi et al's, [19]. One of the two reported not having a big enough sample for meaningful factor analysis while the other combined the Chinese data with those of two other nations. If national culture has the potential to affect attitude toward women managers, a case can be made for the validation of scale items on a national basis before engaging in comparative analyses of the WAMs. There are some commonalities between

this study and the previous one where factor analysis of scale items was successfully utilized. All the scale items for the second factor in Javalgi et al's [19] study loaded on Factor 1 in the current study. The juxtaposition of factor loadings on the two studies with Chinese samples may be an indication of culture-specific attributes on the WAMs . Further research is needed to validate if this is the case.

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Table 1
Gender Differences in Mean Ratings on Women as Managers Scale

Women as Managers Scale		Male (<i>n</i> = 215)		Female (<i>n</i> = 215)		Significant difference between means
Please circle either a 1, 2, 3, 4, 5, 6, or 7 concerning the extent to which you strongly disagree (=1) to strongly agree (=7) with each of the following statements.						
Item		<i>Mea n</i>	<i>S.D.</i>	<i>Mean</i>	<i>S.D.</i>	
1.	It is less desirable for women than men to have a job that requires responsibility.	3.86	1.56	3.40	1.78	**
2.	Women have the objectivity required to evaluate business situations properly.	4.52	1.45	5.61	1.18	***
3.	Challenging work is more important to men than it is to women.	3.76	1.51	4.24	1.73	**
4.	Men and women should be given equal opportunity for participating in management training programs.	4.60	1.52	6.28	1.23	***
5.	Women have the capability to acquire the necessary skills to be successful managers.	4.39	1.51	6.08	1.14	***
6.	On the average, women managers are less capable of contributing to an organization's overall goals than are men.	4.22	1.44	5.20	1.53	***
7.	It is not acceptable for women to assume leadership roles as often as men.	4.53	1.52	6.13	1.24	***
8.	The business community should someday accept women in key managerial positions.	4.34	1.50	5.85	1.21	***
9.	Society should regard work by female managers as valuable as work by male managers.	4.59	1.47	5.97	1.22	***

10	It is acceptable for women to compete with men for top executive positions.	4.44	1.50	6.18	.98	***
11	The possibility of pregnancy does not make women less desirable employees than men.	4.39	1.39	5.67	1.30	***
12	Women would no more allow their emotions to influence their managerial behavior than would men.	3.74	1.48	4.16	1.45	**
13	Problems associated with that “time of the month” should not make women less desirable than men as employees.	3.98	1.34	4.83	1.52	***
14	To be a successful executive, a woman does not have to sacrifice some of her femininity.	4.30	1.51	5.43	1.49	***
15	On the average, a woman who stays at home all the time with her children is a better mother than a woman who works outside the home at least half time.	4.23	1.52	4.93	1.55	***
16	Women are less capable of learning mathematical and mechanical skills than are men.	3.94	1.51	4.27	1.64	*
17	Women are not ambitious enough to be successful in the business world.	4.24	1.35	4.88	1.54	***
18	Women cannot be assertive in business situations that demand it.	3.97	1.37	4.69	1.44	***
19	Women possess the self-confidence required of a good leader.	4.39	1.46	5.43	1.41	***
20	Women are not competitive enough to be successful in the business world.	4.17	1.42	5.52	1.49	***

21 Women cannot be aggressive 4.38 1.51 5.97 1.24 ***
in business situations that
demand it.

* $p < .05$, ** $p < .01$,

*** $p < .001$

Table 2
Principal Components Analysis
Factor Loadings for Women as Managers Scale Items

Women as Managers Scale					
Please circle either a 1, 2, 3, 4, 5, 6, or 7 concerning the extent to which you strongly disagree (=1) to strongly agree (=7) with each of the following statements.					
Item	<i>Factor 1</i>	<i>Factor 2</i>	<i>Factor 3</i>	<i>Factor 4</i>	<i>Factor 5</i>
1. It is less desirable for women than men to have a job that requires responsibility.				.581	
2. Women have the objectivity required to evaluate business situations properly.	.487				
3. Challenging work is more important to men than it is to women.				.740	
4. Men and women should be given equal opportunity for participating in management training programs.	.758				
5. Women have the capability to acquire the necessary skills to be successful managers.	.647				
6. On the average, women managers are less capable of contributing to an organization's overall goals than are men.					.680
7. It is not acceptable for women to assume leadership roles as often as men.	.659				
8. The business community should someday accept women in key managerial positions.	.741				
9. Society should regard work by female managers as valuable as work by male managers.	.681				
10. It is acceptable for women to compete with men for top executive positions.	.787				
11. The possibility of pregnancy does not make women less desirable employees than men.	.502				
12. Women would no more allow their emotions to influence their managerial behavior than would men.			.771		
13. Problems associated with that "time of the month" should not make women less desirable than men as employees.			.661		
14. To be a successful executive, a woman does not have to sacrifice some of her femininity.					.603
15. On the average, a woman who stays at home all the time with her children is a better mother than a woman who works outside the home at least half time.		.414			

16	Women are less capable of learning mathematical and mechanical skills than are men.		.574			
17	Women are not ambitious enough to be successful in the business world.		.713			
18	Women cannot be assertive in business situations that demand it.		.659			
19	Women possess the self-confidence required of a good leader.	.565				
20	Women are not competitive enough to be successful in the business world.	.481				
21	Women cannot be aggressive in business situations that demand it.	.521				

Table 3
Principal Components Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.595	26.641	26.641	5.595	26.641	26.641	4.990	23.763	23.763
2	1.784	8.495	35.135	1.784	8.495	35.135	2.068	9.850	33.612
3	1.418	6.751	41.886	1.418	6.751	41.886	1.534	7.304	40.916
4	1.054	5.021	46.907	1.054	5.021	46.907	1.239	5.901	46.817
5	1.009	4.805	51.711	1.009	4.805	51.711	1.028	4.894	51.711

Extraction Method: Principal Component Analysis.

Table 4
Gender Differences in Mean Ratings on Women as Managers Scale

Women as Managers Scale	Male (n = 215)		Female (n = 215)		Significant difference between means
	Mean	S.D.	Mean	S.D.	
1	4.43	.72	5.88	.70	***
2	4.09	.83	4.70	1.04	***
3	3.86	1.09	4.5	1.21	***
4	3.81	1.16	3.82	1.33	ns
5	4.26	1.00	5.31	1.05	***

The Truncated Normal Distribution in Supply Chain Management

Nick T. Thomopoulos

Professor Emeritus

Illinois Institute of Technology

nthomop@gmail.com

The truncated normal distribution is highly useful in inventory control, since it has many shapes and has a location parameter that is used to determine the shape and how much safety stock is needed for each item. The forecast for an item generates the average and standard deviation on the future demands. This information yields the coefficient of variation, cov , and this measure is used to determine the location parameter for the truncated normal distribution. The truncated normal gives a more precise measure of the safety stock than using only the normal distribution.

SERVICE PARTS MANAGEMENT: AN EMPIRICALLY DERIVED RESEARCH AGENDA

Christopher A. Boone, College of Business, Georgia Southern University, Statesboro, GA, 30458, (912) 478-5310, caboone@georgiasouthern.edu
Joseph B. Skipper, College of Business, Georgia Southern University, Statesboro, GA, 30458, (912) 478-2280, jskipper@georgiasouthern.edu
Benjamin T. Hazen, Department of Operational Sciences, Air Force Institute of Technology Wright-Patterson AFB, OH, (937) 255-3636, benjamin.hazen@live.com
Marc A. Scott, College of Business, Georgia Southern University, Statesboro, GA, 30458, (912) 478-3371, mascott@georgiasouthern.edu

ABSTRACT

Faced with global competition, declining sales, and shrinking profit margins, many firms have adopted some form of service-based model to complement or build existing businesses, shifting their focus from simply improving product manufacturing and delivery to cultivating after-sale service and customer satisfaction. One major component of after-sale service involves service parts management. However, service parts businesses are rarely stand-alone ventures and are typically seen as add-ons to existing business models. As such, many service parts operations are managed using ad-hoc practices that are often subordinated to primary businesses. This research serves to disambiguate this burgeoning area of supply chain management and present a unified agenda for future research.

BACKGROUND

Firms in a number of industries now recognize effective management of service parts as a means of generating customer value and increasing profits [1]. Conversely, firms with inadequate service parts management are likely to experience operational inefficiencies, excess costs, customer dissatisfaction and missed service level agreements [2]. In response, an estimated \$700 billion a year is spent on service parts [3] with another \$100 million spent on systems to help manage them [4]. These totals

reflect investments by industries seeking to ensure availability of assets critical to their manufacturing or customer service operations [5] as well as by firms seeking to profit from the increasingly competitive and valuable after-sales service market [3, 6].

Unfortunately, management of service parts is considered especially challenging due to high levels of demand uncertainty, limited sourcing options, risk of obsolescence, inefficient ordering processes, poor inventory management, part proliferation, ageing systems and parts, and system configuration changes [3, 7-9]. Costs of unscheduled downtimes attributed to the lack of service parts range from \$1,700 an hour [10] to more than \$50,000 an hour [11] in the literature. Thus, managers need simple but robust tools and models that can be applied to their circumstances [12] to inform decision-making and enhance service parts management [13].

Scholars have also taken note of the increased importance of service parts management as evidenced by the numerous publications focused on the topic [14], which are highlighted in a number of literature reviews including those completed by Kennedy, Patterson [7] and Wagner, Jönke [1]. Unfortunately, some suggest that managers are unable to leverage much of the extant service parts research [15, 16] because they perceive the scholarly efforts as lacking a focus on managerial practices [17] with proposed models that are too complex or costly to implement [4] or based on assumptions that fail to consider real life contexts and complexities [14].

To advance service parts management, scholars must respond to both the general calls for industry relevant operations and supply chain research [18, 19] and the specific calls for service parts research focusing on the issues managers believe are important [20, 21]. Martin et al. [14] suggest for service parts research to be more meaningful to

managers, it must consider more holistic approaches that consider the complex environment within which service parts managers operate and seek to combine the typically quantitative approaches of operations research with those found in other business and organizational sciences.

It is this need to highlight the real world context and complexities faced by service parts managers and to explore more holistic approaches to solving industry challenges that serves as the motivation for this study. Building on a series of semi-structured interviews with senior managers from both commercial and government organizations, this research provides insight into the dynamics of service parts management through the development of a model and decision framework depicting the complex environment and decisions faced by service parts managers. We also draw upon well-known organizational and economic theory to suggest future research that is more holistic and meaningful to managers.

Theory offers both scholarly and practical value [22], which has prompted a number of scholars to suggest theory based agendas for addressing important supply chain topics [22-25]. Lundberg [26] goes so far as to suggest frames (i.e. theories) are a requisite for sensemaking and that the better the theory, the better the sensemaking is for managers and scholars [23]. Thus, by suggesting complimentary theoretical lenses through which to view the challenges identified by managers we hope to prompt research capable of narrowing the gap that exists between service parts management research and practice [4].

GROUNDED RESEARCH APPROACH

The grounded approach was introduced in the 1960's by Glasser and Strauss [27]. The advantage of the grounded approach is that it capitalizes on the richness of practitioner insight and data [28], making it one of the more influential paradigms for qualitative research in the social sciences today [29]. Grounded theory approaches are so called because the results are generated not from existing theory, but grounded in data collected from one or more empirical studies [30]. Although traditionally associated with sociology [31], the grounded approach has begun to appear more frequently in supply chain research. For example, Carter and Dresner [32] use a grounded approach to investigate the role of purchasing in environmental management while Flint, Larsson, Gammelgaard, and Mentzer [33] utilized a grounded approach to explore innovation within a logistics context through the eyes of logistics managers. Similarly, this effort seeks to explore the objectives and challenges of service parts management through the eyes of practicing service parts managers.

The grounded approach relies on a systematic analysis of qualitative data [31]. The qualitative data are typically collected through interviews, and then transcribed in preparation for analysis [30]. The analysis of the interview data consists of three coding phases: open, axial, and selective [34]. During open coding, the researcher categorizes the data into emerging themes or categories [30] originating from the data rather than pre-defined assumptions from an outside source [35]. The researcher then seeks relationships between the identified categories during axial coding [30]. Axial coding involves the reduction of the original list of concepts [36] by relating the identified categories and developing a more consolidated and comprehensive scheme [37]. Finally, selective

coding is the process of integrating and refining the categories [34] in order to focus on the core concepts [30]. In selective coding, the researcher develops a narrative that integrates the results of the axial coding [38]. These steps were followed in this research in order to establish the models described in the following sections.

Data collection consisted of a series of semi-structured interviews with senior service parts managers. Diversity was sought amongst the panel members in terms of their experience and backgrounds in order to provide an expansive view of service parts management and to facilitate the development of a general yet robust model. Thus, senior service parts managers from a variety of industries as well as third party service parts support providers were solicited. Specific efforts were made to include managers from those industries identified by Fortuin and Martin [9] as the most frequently studied in service parts research (i.e. electronics, automotive, aviation, & production). In addition, service parts managers from other industries highlighted in prior research were solicited including those focused on utilities [39], medical equipment [40], military operations [41], and heavy equipment manufacturing and support [42].

In total, 17 managers agreed to participate and were interviewed. The participants averaged nearly 19 years of service parts experience across a wide range of specific industries including aviation, automotive, heavy equipment, manufacturing, medical, technology/computing, and utilities. In addition, a number of the participants were from service providers with experience spanning multiple industries (Table 1).

Table 1: Interview Participants

Title	Industry
Assistant Program Executive	Aviation
Logistics Manager	Manufacturing
VP Business Development	Automotive
Supply chain Analyst	Medical Equipment
Director of Testing and Facility Support	Manufacturing
Director of Planning Services	Medical Equipment
Service Parts Inventory Manager	Heavy Equipment
Logistics Analyst	Military Aviation
Deputy Director of System Support	Military Maritime
Logistics Analyst	Multiple Industries
Director of Client Service for Medical Equipment Repair	Medical Equipment
Logistics Analyst	Military Aviation
General Manager	Multiple Industries
Director, Supply Chain and Logistics	Automotive
Director of Procurement & Materials Management	Utility
Director of Marketing	Technology/Computing
Logistics Manager	Automotive

The vast experience and diversity of industry experience represented by the participating managers allowed for the development of models believed to reflect the objectives and key decisions areas for service parts managers. These results and implications are discussed in the sections that follow.

INDUCTIVE MODEL DEVELOPMENT AND PROPOSED RESEARCH AGENDA

Performance Objectives:

Participants were first asked to discuss their primary performance objectives related to service parts management. Insights gained from the managers allowed for the development of a service parts performance objective model (Figure 1), which highlights

the complex environment within which service parts managers operate. The obvious objective of effective service parts management is to satisfy customers by providing the necessary parts, at the needed location, for a reasonable price, at the desired time [3]. Though seemingly straightforward, the data revealed that achieving this objective is actually a complex balancing act. When asked about the primary objective of their approach to service parts inventory management, the participants provided a variety of responses. Through open and axial coding, the data revealed four concepts: maximize part availability, minimize cost of providing service parts, minimize the number of system disruptions, and maximize customer service and satisfaction (Figure 1).

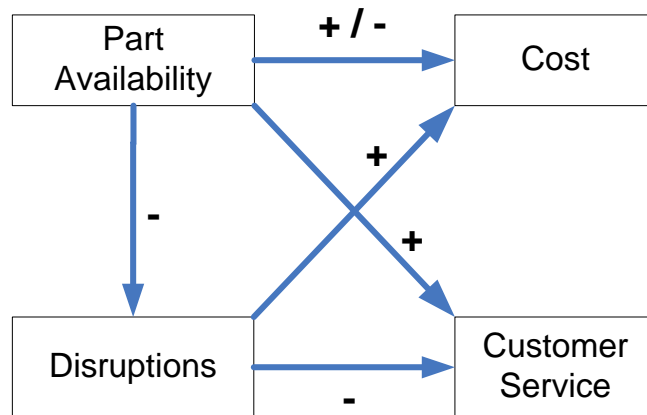


Figure 1: Performance Objective Model

Further, extant research describes these four performance outcomes to a great degree, as shown in Table 2. However, this research typically examines each performance outcome in isolation, without addressing the effects on multiple outcomes identified in this research, or examining the interplay between performance outcomes. Indeed, a key finding of the current research is that a more holistic approach to examining performance outcomes is needed. Because each of these outcomes cannot be described in

isolation, each performance objective is discussed herein in consideration of other objectives.

Table 2: Research Regarding Performance Outcomes of Service Parts Management

Performance Objective	Research Example
Parts Availability	Dekker et al., 1998 Schroter and Spengler, 2004 Chang et al., 2005 Louit et al., 2011 Ghodrati et al., 2013 Kazemi Zanjani and Noureifath, 2014 Behfard et al., 2015 Jiang et al., 2015
Disruptions	Perez and Sanchez, 2001 Skipper et al., 2010b Li and Ryan, 2011 Burns and Marx, 2014 Sawik, 2014 Sawik, 2015
Cost of Providing Service Parts	Papazov and Tashev, 1988 Evers, 1999 Tibben-Lembke and Amato, 2001 Thonemann et al., 2002 Wong et al., 2005 Topan and Bayindir, 2012 Alptekinoğlu., 2013 Behfard et al., 2015 Diabat et al., 2015 Guajardo and Rönnqvist, 2015
Customer Service and Satisfaction	Gilmour et al., 1976 Cohen et al., 1989 Zeng, 2003 Kim and Park, 2008 Kranenburg and van Hourtum, 2008 Wikner and Tang, 2008 Tysseland, 2009 Skipper et al., 2010a Makarova et al., 2011 Mondragon et al., 2011 Huscroft et al., 2013 Alvarez et al., 2015 Leyer and Moormann, 2015

Parts Availability: At the heart of this complex interaction lies the objective of having parts available and accessible upon demand by customers. As demonstrated in Figure 1, an objective of increased service part availability is to decrease inventory cost and system disruptions, and increase customer service. Increased part availability is expected to reduce the total number of inventory related disruptions by having parts available when required for service, thus providing improved customer service. However, an increase in availability typically requires an increase in on-hand inventory and thus an increase in overall cost of providing the service parts. The lack of available parts may also increase costs by necessitating the use of expedited processes to satisfy customer demands. This delicate relationship between availability and cost is what prompted many of the participants to indicate that their primary objective is to seek a balance between the two. According to one participant, the true challenge is to understand the cost to make the part available as well as the cost associated with not having the part available.

A brief review of literature finds support for these findings. Extensive research has been conducted in this area to include studies on machine availability [43], preventative maintenance [44], and level of repair Chang et al., [45] across industry segments such as Original Equipment Manufacturers [46], third-party providers [47], and electronics repair [48]. Despite research demonstrating the impact of parts availability on overall cost [49] and customer service [50], the data from the current research suggests a gap between extant research and managerial application in that most research examines only direct relationships between service parts management and one area of performance.. Such research is instrumental in determining the relationships between

these concepts, but does not take into account the holistic nature of service parts management performance. Indeed, more research is needed to holistically examine the performance outcomes of service parts management, as well as relationships proposed in Figure 1.

Disruptions: Lack of a needed service part can prove very costly. Thus, many of the service parts managers described the need to focus on the essentiality and criticality of the parts they managed in an effort to reduce the number of disruptions of the systems they supported. This was especially important to those in the manufacturing, aviation, computer network, and utility industries. An increase in the number of disruptions in one of these industries can result in increased cost and lost opportunities (e.g. lost sales, cancellations, delays). Skipper et al., [51] point out the broad ranging impact of service disruptions. Ranging from automotive parts providers [52, 53] to machine parts [54], a disruption in the availability of service parts has devastating impact on customer service [55, 56].

A service parts manager from the utility industry estimated that the lack of a service part, which required a power unit to reduce power or shut down, could result in a loss of up to \$1 million in revenues per day. A service parts manager tasked with supporting a large network provider estimated that for every one hour the network was down, the companies utilizing that network combined for a loss of nearly \$80,000 in revenue per hour.

Cost of Providing Service Parts: The participants indicated that controlling the costs associated with holding and managing inventory was an important objective of their service parts management efforts. There are many factors that influence the cost of providing service parts inventory. Ranging from warehousing and distribution center [57-59] to labor [60] and forecasting [61], cost research in spare parts is far reaching. Several research efforts also incorporate cost saving measures such as pooling [62-64] and postponement [46, 65].

Participants in the current research pointed to rising costs in warehousing as a driving force behind the need to reduce storage space requirements. Another participant pointed to the cost of labor as a key driver of the cost of providing service. Still another pointed to the increase in fuel costs as a critical factor that must be considered. Of course the primary means for reducing costs is to simply reduce the amount of on-hand inventory. However, many of the service parts managers warned that efforts to “lean” service parts inventory must be entered into cautiously. Unlike most manufacturing inventories, the lack of service parts inventory can mean the complete shutdown of an organization’s operations.

Customer Service and Satisfaction: Underlying all of the aforementioned objectives is a focus on customer service and satisfaction. Whether through the reductions in cost, availability of parts, or minimization of disruptions, the primary objective of service parts management is customer satisfaction. A number of the participants highlighted this with comments like: “our focus is always on the customer,” “our primary goal is customer satisfaction,” or “our sole objective is customer satisfaction.” Indeed, service parts

management processes must be established to meet the specific needs of each customer in each environment. This requires flexibility on the part of service parts managers requires a delicate interplay, and continuous review of strategies and procedures.

The research involving the impact of spare parts availability on customer service is quite significant. In this area, research efforts, primarily models, cover a broad range of topics including stockage policies [66-68], network management [69-71], warranties [72], remanufacturing [73-75] and service differentiation [76-78]. Although this research typically addresses each topic in a comprehensive manner, it rarely takes into account the delicate interplay between all facets of customer satisfaction.

Theoretical lens for examining service parts performance objectives: Contingency theory is especially well suited for investigating the complexities of service parts management, but has thus far been rarely used in this literature stream. Contingency theory suggests organizational performance is maximized when processes and structures “fit” the environment [79], suggesting service parts managers can be most effective by opting for strategies or tools that best complement their specific circumstances [4, 80]. Using a contingency theory approach, scholars could provide especially useful insights for managers by exploring the effectiveness of different strategies or techniques in varying contexts or environments.

Contingency theory implies that firms adapt to changes in their environment by modifying their approach to competition in order to maintain or enhance performance [81]. The willingness and ability of organizations to deal with changes in their operating environment has been documented as a cornerstone of firm strategy and performance [82-

84]. Contingency theory provides a basic rationale for emphasis on flexibility-based strategies that represent a strategic response to emerging threats [85, 86]. Bracker [87] argued that firms utilize resources as necessary to achieve specified objectives within a specific competitive environment and under specific conditions. This view can be most helpful in examining the utilization of service parts resources.

The application of strategy and strategic planning processes focus the organization's resources in a manner that enhances firm performance via a competitive driver, such as flexibility [86]. The importance of strategy can be identified in two primary areas. The first is seen in the identification of the organization's core objectives and thereby its' current and future direction. Second, strategy guides the process by which firm resources are developed, organized, and allocated in order to achieve selected objectives [86].

Contingency theorists have argued that strategic planning linked to performance increases the understanding of the "situational" effects of planning on performance [88-90]. Wolf and Egelhoff [91] go on to add that strategic planning fosters a consistent conceptualization of strategic planning characteristics and their relationships to different organizational and environmental characteristics. Lorange and Vancil [92] stated that strategic planning systems have two major functions: to develop an integrated, coordinated, and consistent long-term plan, and to facilitate long-term corporate adaptation to changes in its external environment. The impact of organizational environment on organizational processes has been extensively studied with emphasis on the need for flexibility and protection from turbulent environmental conditions [93-96]. This emphasis on the strategic nature of service parts management can inform research

seeking to examine the role that after-sales service can play in an organization's business strategy.

Decision Support Requirements

When asked to consider the most critical decisions they faced as service parts managers, the participants provided a wide range of responses. Through open and axial coding, these data revealed both upstream and downstream challenges. Figure 2 presents these concepts, relative to the service parts provider. Each is discussed further in the sections that follow.

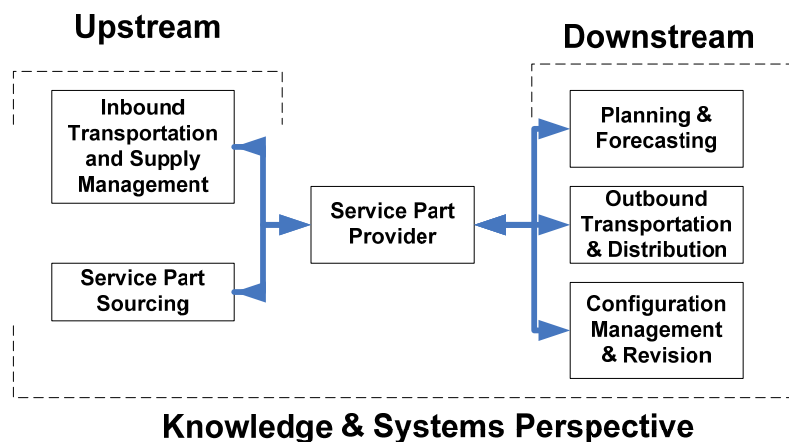


Figure 2. Decision Support Framework

Upstream Requirements: The concept of upstream challenges refers to those issues influencing the service provider's acquisition and receipt of parts. Chief among these upstream challenges is service part sourcing and inbound transportation and supply management.

Service Part Sourcing: While service parts managers must deal with many of the common challenges of inventory sourcing such as a lack of supplier visibility and lack of supplier integration, many of the challenges they face are unique due to the types of parts managed. One such challenge deals with the requirement to support ageing systems or assets. One participant with a military aviation background reported that the a majority of the assets he supported were at least 18 years old with some assets nearing 40 years in age. Manufacturing of such systems has long ended and spare parts are often difficult to obtain, requiring the part to be manufactured if repair is not possible.

One of the manufacturing participants indicated that the large diversity of parts and the limited number of suppliers for many of the parts limited his organization's leverage with suppliers. The volume of parts from any one supplier was such that no price breaks could be negotiated. Other parts have such a limited number of suppliers to choose from that negotiation was again not helpful in reducing purchase cost. These issues highlight the need for decision support with regard to part sourcing.

Inbound Transportation and Supply Management: Inbound transportation and supply management, though not unique to service parts, also warranted mention by the participants as being a key challenge of service parts management. Several participants highlighted the challenge of managing variability in shipping times and the variability of the quality of parts received. Variability on timing or quality has a direct impact on service parts managers' ability to plan and respond to demands for service, highlighting the need for adequate decision support regarding inbound shipment and transportation management.

Participants also highlighted the pressure to reduce the amount of on-hand inventory and the amount of required storage space. Excessive inventory and storage space both contribute to increased cost of service parts management. There is constant pressure to reduce both in order to reduce costs and to remain competitive. Therefore, managers noted the need for decision support related to optimizing spare part inventory turnover rates.

Regarding the upstream requirement areas of Service Part Sourcing and Inbound Transportation and Supply Management, our data complements and extends extant literature in this area. From researched aimed toward establishing a systematic, optimal spares stocking policy [97] to improving systemic management of lead time [98] or lowering supplier quality variance [99], multiple studies indicate the importance of upstream management. The findings herein provide a framework for additional investigation, and suggest that upstream requirements can fall under two general categories, as specified above. In addition, as suggested by literature and the data, much more work is needed in these areas.

Upstream Theoretical Lens: In order to extend research in the upstream area, two specific theory sets are particularly appropriate. The first is resource dependence theory. The theory has two major tenets, which are that 1) firms need scarce external resources and 2) these firms will strive to minimize their dependence on those holding the resources [100]. Building on resource based view research of Hunt and Davis [101] and social exchange theory application of Pulles et al. [102], this resource dependence theory may prove especially promising in the investigation of the challenges associated with service parts sourcing. As this theory is primarily concerned with a firm's trading dependence with its

partners and the environment in which it operates, it may help to explain actions taken to 1) reduce that dependence, 2) improve sourcing, and 3) maximize the power an organization can wield in its environment [103].

The second theory that provides a useful perspective in the upstream category is network theory. A primary tenet of network theory involves the concept of centrality, referring to the importance of a firm, or organization, within a network [104]. Highly central organizations would enjoy relationships with other network members that would provide increased speed and lower cost than that experienced by other organizations [23, 105]. In the context of service parts, this theory would help to explain or defend organizational actions taken to increase, or improve, relationships and cooperation with trading partners to improve an organization's position or competitive advantage in either upstream or downstream operations. This would include the sharing of information [106], and the ability to exploit an opportunity [107].

Downstream Requirements: The concept of downstream challenges refers to those challenges that influence the service provider's ability to forecast and satisfy customer needs. Three key areas emerged from the data: planning and forecasting, outbound distribution, and configuration and revision management. Each is discussed further below.

Planning and Forecasting: Nearly every participant identified planning and forecasting as a challenge to service parts management. Planning and forecasting for service parts is inherently complex. Though some problems can be avoided through preventive or time-based maintenance, part and system failures drive demand for service parts. For new

systems, accurate forecasts are difficult due to the lack of failure data. Similarly, it is difficult to plan service parts needs for ageing systems, whose failure rates grow increasingly unpredictable as the system ages. Forecasts for service parts in their normal use phase are only slightly less complex. Though demand data may be more readily available, forecasters and planners often lack visibility of asset usage, which is a key contributor of part failure. This area therefore represents perhaps the greatest need for decision support mechanisms.

Outbound Transportation and Part Distribution: Several challenges emerged regarding the distribution of service parts to customers. Principal among these is the challenge of being responsive to customer needs. In the case of medical equipment, service is often required in hours, not days. Such a level of service requires constant and careful consideration of service part locations and transportation options.

Responsiveness also requires the careful management of the repair cycle process, especially for those parts for which there is limited supply. The repair cycle process includes all stages through which a repairable service part passes from the time of its removal until it is reinstalled or returned to stock in a serviceable condition. The data suggest that the challenge for service parts managers seeking an efficient repair cycle process lies in ensuring the timely return of unserviceable parts by field service providers and customers as well as the appropriate prioritization of repair by the repair providers.

Other common challenges associated with outbound distribution of service parts included the variability in distribution times and its potential negative impact on customer service. Some participants suggested that ensuring service parts were protected from

damage during delivery to customers was often a challenge. Still others described the rising cost of labor and fuel as key challenges to efficient service parts distribution.

Configuration Management and Revision: Several of the participants noted the challenge of maintaining accurate system configuration data. Several experts from technology dependent industries described the challenge of maintaining accurate part configurations due to the rapid rate at which products are revised and new versions introduced.

However, experts from more conventional industries, such as aviation and manufacturing, also suggested the challenge with maintaining accurate part configuration data due to system or asset modifications. Failure to maintain accurate configuration data can quickly lead to a situation in which the service provider is holding an abundance of obsolete inventory and unable to meet customer demands for new parts.

In the downstream component of our study, we also see support for our findings in literature. The importance of the relationship between buyer and supplier has received much interest from scholars. For example, Holmstrom et al. [108] and Cassivi [109] point out the importance of widespread collaboration in forecasting and replenishment between supply chain partners. Similarly, the impact of outbound transportation [110, 111], distribution networks [70, 112], and part variation [113] has been found to have significant impact on the overall performance of inventory management systems. This current study contributes to this stream of literature and suggests a continued need for more research on the topic.

Downstream Theoretical Lens: Resource orchestration theory seeks to explain how firms can use their assets, or resources, more effectively [114]. The theory argues that whether or not a firm has all of the resources that it may need, it is more important to examine

how the resources are managed across three areas: breadth of firm, life cycle, and depth of firm [115] and across time as internal and external environments change [116]. Because service parts are part of inventory and inventory is a resource [117], organizations that manage and utilize this resource more effectively should develop a competitive advantage. Therefore, if a firm is more effective and efficient at managing their spare parts inventory to meet demand, that firm has successfully turned an inventory asset into a resource advantage. In the context of the findings of this study, this would apply to both up and down stream inventory management.

The organizational information processing view [118, 119] can also be useful for research in this area. Given the turbulent environment of service parts supply chains, decision-making is marked by high levels of uncertainty and equivocality [120]. Galbraith [118] suggests that as uncertainty and equivocality increase, organizations alter their processes and information processing requirements increase. Information processing capability denotes the ability to fulfill these requirements, and fitting capabilities to requirements is an important means toward enhancing information processing and thus performance [121]. Information processing requirements are a function of task characteristics (i.e. complexity) and the task environment (i.e. turbulence) and are marked by task complexities [119]. Information processing capabilities are enhanced via improving routines and task accomplishment, which are bolstered via fostering lateral relationships and using appropriate information technologies. Although many aspects of the information processing view can be useful, research on improving lateral relationships and utilizing technologies can be especially fruitful for informing service parts supply chain management theory and practice.

CONCLUDING REMARKS

Those that manage service parts effectively can realize improved customer loyalty and higher profits [1], while poor management of service parts can have a detrimental impact on the entire supply chain [122]. Thus, service parts management is an increasingly valuable and important part of many modern supply chains. Using a grounded approach, this study provides added insight into our understanding of the complexity associated with service parts by highlighting the key performance objectives and decisions facing service parts managers. This research found that the objectives of service parts management are highly interrelated. Managers of service parts must maintain a delicate balance between cost and availability, and must pay careful attention to the potential cost of disruptions caused by a lack of service parts and constantly seek to improve customer service. We also gained insights into a multitude of challenges service parts managers must overcome in order to achieve these objectives. The upstream challenges related to the difficulties associated with service part acquisition and receipt while the downstream challenges focused on the difficulties in predicting the need for service parts and the challenges of providing those service parts to customers.

In describing these objectives and challenges, this effort represents a unique resource for future scholars seeking to contribute to the knowledge of service parts through managerial focused and relevant research and adds to the discourse on after-sales service and lifecycle management [123-125]. The theories suggested also promise to shed new light on service parts management which we believe will help create a more holistic view of service parts management and help narrow the gap between research and practice.

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FLEXIBLE FACTORY: ADAPTING TO VOLATILE MARKET

Osam Sato, Tokyo Keizai University, 1-7-34 Minami-chou, Kokubunji-shi, Tokyo 185-8502
Japan, (+81)423-28-7934, osamsato@tku.ac.jp

Yoshiki Matsui, Graduate School of International Social Sciences, Yokohama National
University, 79-4 Tokiwadai, Hodogaya-ku, Yokohama-shi, Kanagawa 240-8501, Japan, +81-
(0)45-339-3734, ymatsui@ynu.ac.jp

Tomoaki Shimada, Graduate School of Business Administration, Kobe University, 2-1
Rokkodai-cho, Nada-ku, Kobe 657-8501 Japan, +81 (0)78 803 7229, shimada@b.kobe-u.ac.jp
Yutaka Ueda, Faculty of Economics, Seikei University, 3-3-1 Kichijoji-Kitamachi, Musashino-
shi, Tokyo 180-8633, Japan, (+81)422-37-3589, ueda@econ.seikei.ac.jp

Hideaki Kitanaka, Faculty of Commerce, Takushoku University, 3-4-14 Kohinata, Bunkyo-ku,
Tokyo 112-8585 Japan, (+81)3-3947-9445, kitanaka@ner.takushoku-u.ac.jp

ABSTRACT

Every market changes rapidly today. Customers' preference is volatile and a market surges and shrinks in a short time. Manufacturers must adapt to the rapid change to survive in the harsh competition. Flexibility should be the prime capability for any manufacturing plant (Jain et al., 2013). Kim et al. (2014) claimed that manufacturing flexibility creates positive effect on supply chain responsiveness. Many factors influence manufacturing flexibility. Among them, Just-in-time (JIT) strategy is important. It includes some tactics, such as machine setup time reduction, Kanban, and close equipment layout. For example, if a plant reduces machine setup time, adaptation to market change becomes easy. Therefore, it is an important JIT tactics. However, some other related factors or tactics are necessary to achieve machine setup time reduction. At first, equipment layout should be close to each other for smooth machine setup. Second, labor force must be flexible. Multi-functional capability of employees is necessary for flexible machine setup and production. Kanban, a JIT tactics, play an important role too. Work-in-process inventory should be small to allow frequent machine setup, and Kanban system enables it. These JIT tactics relate to each other and some are antecedents to others. Therefore, managers should design JIT strategy after considering the cause-and-effect relationship among JIT tactics as well as human resource management (HRM). In this study, we developed a structural equation model (SEM) with JIT tactics and HRM, and applied our international data. Many empirical studies have been published about both JIT and HRM. However, few studies have considered both of the factors at the same time or the interaction between the factors.

INVESTIGATING APPROXIMATE STATISTICAL PROPERTIES OF SCALED PROBLEM INSTANCES OF SIMPSON'S PARADOX USING BIG DATA CLUSTER COMPUTING TECHNIQUES

Robin M Snyder, 912-961-9600, robin@robinsnyder.com

ABSTRACT

This paper uses big data cluster computing techniques to investigate the approximate statistical properties of scaled problem instances of Simpson's Paradox. A visualization is presented for Simpson's Paradox. Although the problem is intractable, big data cluster computing techniques are used to determine the instances of ball combinations checked and the instances of Simpson's Paradox found and ratios determined and plotted. This can be used to help approximate and understand the asymptotic behavior of Simpson's Paradox.

INTRODUCTION

In his book Probabilistic reasoning in intelligent systems, Judea Pearl, winner of the 2011 ACM Turing Award for "**For fundamental contributions to artificial intelligence through the development of a calculus for probabilistic and causal reasoning**", makes the following observation in reference to Simpson's paradox.

Imagine your family physician saying, "This drug seems to work on the population as a whole, but it has an adverse effect on males ... and an adverse effect on females." Only when you look at the numbers and agree to interpret the phrase "seems to have an effect" as a statement about a change in proportions do you begin to see that the calculus of proportions clashes with our intuitive predictions [6, p. 496].

Pearl say this about human intuition for such problems.

It appears that the machinery invoked by people for such tasks amounts to approximating the calculus of proportions by some expedient abstraction. The machinery may be adequate for an idealized model of these proportions but would not respond to all their fine details [6, p. 496].

The paradox appears from time to time in actual, and sometimes important, circumstances. Such examples are omitted but the reader can do an Internet search search for "**Simpson's Paradox examples**" to find many examples. Understanding the paradox and implications is part of numerical literacy as described in [5].

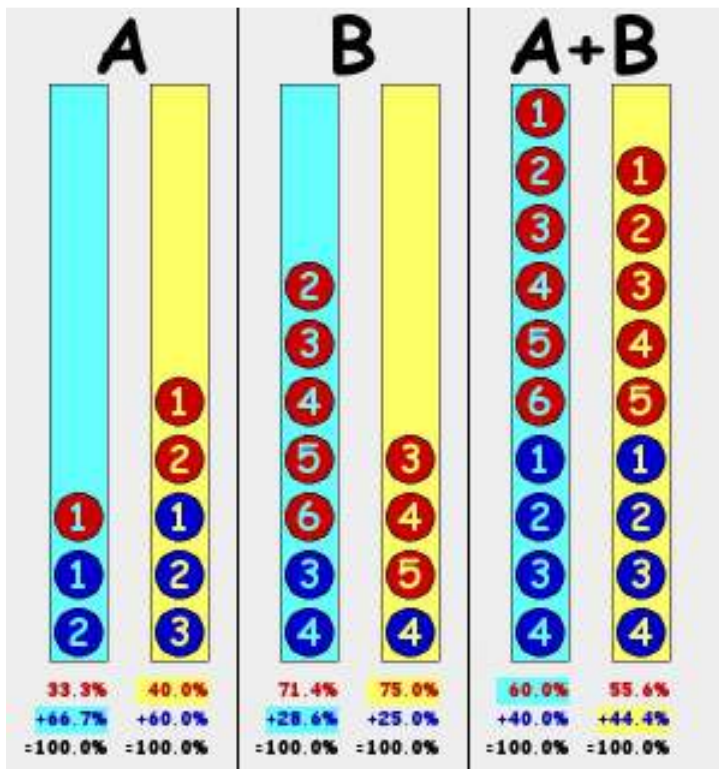
Previous work by the author investigated finding minimal instances of Simpson's Paradox through simple code prototyping [8]. That code used the Lua scripting language [4].

In simple form, if there are n balls to be distributed between red and blue balls and then distributed between 4 jars that each have at least one color of each ball in them, then there are 8 degrees of freedom which requires 8 simple nested loop bodies (i.e., an outer loop and 7 inner loops). This makes the problem intractable in general but, with the increasing cost and power of small computers (e.g., credit card size computers) it becomes easier to increase the value of n - the total number of balls used and therefore get a better approximate idea of the asymptotic statistical behavior of Simpson's Paradox.

PROBLEM VISUALIZATION

Simpson's Paradox is here presented using a visualization of Simpson's Paradox, created by the author, and whose details and alternatives will be discussed in future work by the author.

The visualization uses a minimal instance of Simpson's Paradox, using 19 balls, as investigated in previous work by the author.



Here is a description of the visualization, which assumes that the reader is not color blind and can distinguish between red and blue (an upcoming visualization will use black and white balls that would also work for gray-scale visualizations).

There are two types of colored balls - red and blue.

The balls are numbered but the numbering is only to help in visually keeping track of the numbers of balls.

There are three cases, A, B, and A+B.

Each case has two jars/bags, represented here more as tubes than balls to make counting colors easier. The term tube/tubes, which follows from a physical kinesthetic example created by the author, and will be used interchangeably with jar and/or bag.

The left tube for each case is color-coded as cyan/teal while the right tube for each case is color-coded yellow.

The case A+B has the corresponding balls from A and B combined. The numbering and color-coding of the balls helps to visually check this combining of balls.

The reader is to put all of the balls in a tube into a jar/bag and then, blindfolded (i.e., randomly), pick out a ball from one of the jars, for sets A, B, and A+B (each with two jars/bags).

The goal of the reader is to pick out a ball of a given color, blue or red.

To assist the reader, who can then check the percentages, the percentage of each color is listed below each tube.

For each tube, the color that has the highest probability of being picked is highlighted in the color of that tube.

So, for the color red:

- In case A, select from the right (yellow) tube.
- In case B, select from the right (yellow) tube.
- In case A+B, select from the left (cyan) tube. This is the paradox.

For the color blue:

- In case A, select from the left (cyan) tube.
- In case B, select from the left (cyan) tube.
- In case A+B, select from the right (yellow) tube. This is the paradox.

A primary objective in the visualization, to be discussed in more depth in a future work by the author, is that the visualization should allow the reader to check individual parts of the visualization that lead to the overall result. The rest of this paper investigates the approximate asymptotic behavior of Simpson's Paradox using big data cluster computing techniques.

CLUSTERS

Cluster computing allows more than one machine to work on a problem at a time, or, in this case, different machines to work on different instances of a problem (e.g., the total number of balls for

an instance). Previous work by the author provides for a simple but effective way to use Node.js to coordinate clusters of machines [9].

For this problem, the author used up to 8 cluster machines were used at any one time.

Node.js is used to coordinate the clusters. Node.js (cantelon2013node,19), at <http://www.nodejs.org>, and often pronounced as just "Node", is, from their web site description: *Node.js® is a platform built on Chrome's JavaScript runtime for easily building fast, scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.* Node.js uses the JavaScript programming language. See, for example, [2], [7]

The server machine and each client machine in the cluster uses the same Python script set up (server machine) and do the computations (client machines) using node.js to coordinate the scripts. Python is a simple, effective, and popular programming/scripting language. See, for example, [3], [1].

The details of this cluster computing are omitted but here is the general approach (node.js is already running)

- Start the Python code on the server machine.
- The Python code creates a set of "**keys**" for the tasks (i.e., the total number of balls for the instance)
- Start node.js with the set of "**keys**".
- Distribute the Python code from server to client machines.
- Start the Python code on the client machines.
- Client machines keep requesting the next "**key**" from node.js and processes it.
- node.js provides running status of progress.

The Python code can determine if it is the "**server**" or a "**client**" and can take appropriate action. The Python code to create ball instances and check paradox instances is omitted but is very similar to the Lua code previously published by the author.

RESULT FORMAT

Each result was saved in JSON format. Here is the JSON text file for the result of checking 85 balls.

```
{
  "checked": 4529365776,
  "hw": "UBUNTU7",
  "elapsed": "44221.578",
  "zeros": 1,
  "date": "2015-07-27",
  "found": 26745148,
  "os": "linux2",
```

```
"size": 85
}
```

In this case,

- The number of instances checked was 4,529,365,776 (about 4.5 billion instances).
- The number of instances found was 26,745,148 (almost 27 million).
- The elapsed time was 44,221.578 seconds (about 12 hours and 20 minutes)
- The hardware name was UBUNTU7 (i7 laptop with 16GB RAM)
- The instances by percent can be calculated to be about 0.006 or 0.6%.

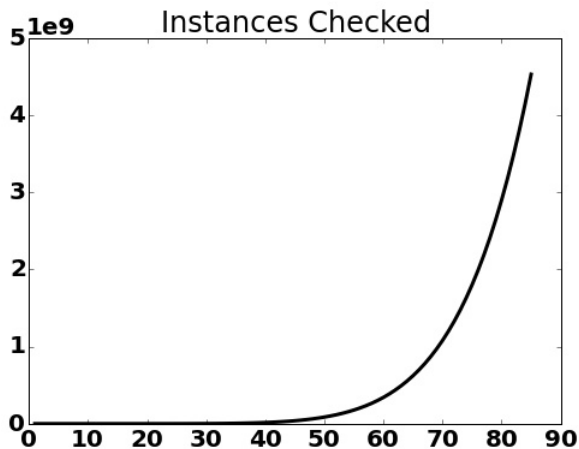
There were then, 85 result files. The minimal result found was for 19 total balls of which 8 instances were found in 31,824 instances checked in 0.5 seconds. Here is the JSON file.

```
{
  "checked": 31824,
  "hw": "AX8",
  "elapsed": "0.500",
  "zeros": 1,
  "date": "2015-10-02",
  "found": 8,
  "os": "win32",
  "size": 19
}
```

The overall results and asymptotic behavior can be better visualized by, of course, using visualization techniques. What follows are various visualization

BASS INSTANCES CHECKED

Here is the chart of ball instances checked where the x-axis is the total number of balls and the y-axis is the number of ball instances checked.

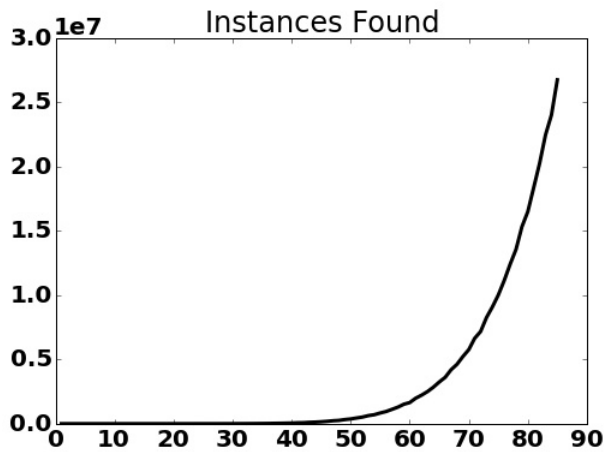


Since symmetries in the problem are not used, this is the total number of instances possible for a given number of balls.

For 85 balls, the number of instances checked was 4,529,365,776 (about 4.5 billion instances).

PARADEX INSTANCES FOUND

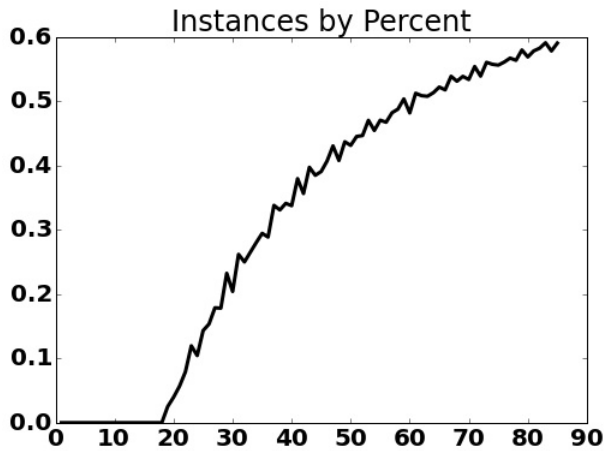
Here is the chart of paradox instances found where the x-axis is the total number of balls and the y-axis is the number of paradox instances found.



For 85 balls, the number of instances found was 26,745,148 (almost 27 million). This total increases exponentially.

INSTANCES BY PERCENT

Here is the chart of instances by percent where the x-axis is the total number of balls and the y-axis is the number of instances by percent.

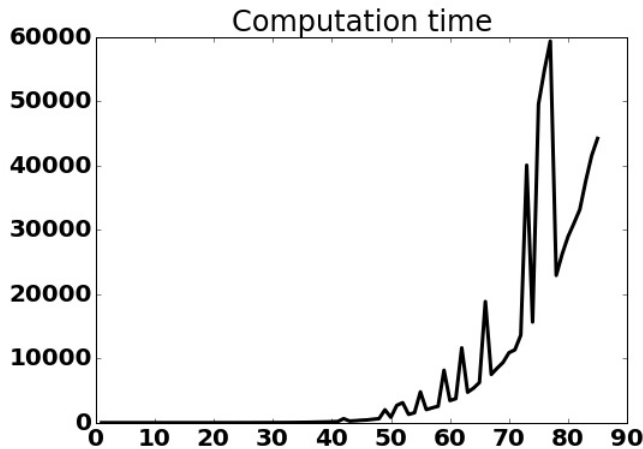


For 85 balls, the ratio of the paradox instances to the ball instances, by percent, was about 0.006 or 0.6%. This total increases exponentially too but not as fast as the instances found.

From the experimental results, it would appear that the instances by percent would appear to asymptotically approach 1.0%. Future research will attempt to refine this approximation.

COMPUTATION TIME

Here is the chart of computation time where the x-axis is the total number of balls and the y-axis is the time, in seconds, for the computation.



As expected, the computation time to check instances increases exponentially. The jagged points in the curve effectively represent two curves. One set of four machines had AMD processors (4 cores each) that were much slower than the other four machines which had Intel I7 processes (8 cores each)

For 85 balls, the elapsed time was 44,221.578 seconds (about 12 hours and 20 minutes)

Making use of symmetries in the problem would help reduce the computation time but since the calculation is requires exponential time, the marginal improvement of halving the computation time for an instance would allow about one more instance to be done (i.e., 86 total balls in 12.5 hours).

FUTURE WORK

Future research work includes the following.

- Determine symmetries that make the computation more efficient.
- Determine ways to automatically detect, check, and then use symmetries of the computation.
- Determine ways to better visualize Simpson's Paradox.

- Investigate the development of mathematical models for the asymptotic behavior of Simpson's Paradox.
- Look at higher dimensions (i.e., more than two colors of balls) of Simpson's Paradox.
- Use multi-core processing to speed up the overall computations.

SUMMARY

This paper has used big data cluster computing techniques to investigate the approximate statistical properties of scaled problem instances of Simpson's Paradox. The results discovered are reported in various visualization ways.

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SUGGESTIONS FOR PRESENTING RESULTS VISUALLY FOR INTRODUCTORY STATISTICS TOPICS

Kellie Keeling, University of Denver
Department of Business Information & Analytics
Daniels College of Business
2101 S. University Blvd, Denver, CO 80208
(303)871-2296; kkeeling@du.edu

ABSTRACT

There are many suggested ways for presenting statistical results, but a visual presentation can often help to guide the reader in focusing in on the most important parts of the results, rather than a paragraph description or a lengthy table. In this paper, I will explore suggestions for presenting the results of some basic statistical analysis typically covered in an introductory statistics course. The focus will be on presenting the results with a visualization. The designs will focus on three parts. First, a graphical representation of the data. Second, a graphical representation of the test (if needed). And third, the important statistical measures of the test (such as the mean, p-value, or t statistic). The analyses covered will be Descriptive Statistics, Two-Sample t Tests, ANOVA, and Regression. The results will be presented with instructions for using Excel and R as tools for creating the visualizations.

Exploring Uses for Data Mining in Academia

Carin Lightner-Laws, Clayton State University, Morrow, GA, carinlightner-laws@clayton.edu

Constance Lightner, Fayetteville State University, Fayetteville, NC, clightner@uncfsu.edu

The origins of data mining can be traced back to the 1970s when computer scientists were making strides in Artificial Intelligence. Some of the first successful applications of data mining were for market research and to detect credit card fraud. Similarly, data mining has been applied to numerous fields ranging from the financial sector to homeland security. In the past 10 years a growing number of universities have turned to data mining to better understand learning trends of students, to improve retention rates and to analyze learning outcomes associated with various accreditation agencies. Researchers have used data mining to predict risk factors that impact a student's ability to successfully complete a course, to detect user patterns associated with passing grades, and to devise retention strategies for at risk groups. Platforms such as Web CT and Blackboard collect data regarding grades, assessment completion traits, frequency that course material is accessed and discussion board participation. The platforms seamlessly provide data analytics to help academics with understanding how their students are performing at various junctures of the course. Since many of the learning platforms already collect extensive data on each student enrolled in the course, there are limitless implications for how academic institutions can use the data, data analytics and data mining techniques to improve the overall learning environment. Typically, most data mining techniques can be classified in 4 basic categories: predictive models, descriptive models, pattern models and anomaly detection models. The purpose of this research is to explore different types of modelling techniques, review fundamental concepts of data mining, and examine how data mining is being used in academia.

Addressing Challenges for Teaching Business Statistics

Session Chair: Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Presenters and Panelists:

Pam Burch, Virginia Commonwealth University, pburch@vcu.edu

Kim Melton, University of North Georgia, Kim.Melton@ung.edu

Weiyong Zhang, Old Dominion University, wyzhang@odu.edu

Ben Marlin, Army Logistics University, bjmarlin@vcu.edu

Abstract: Session will address teaching in large classes, updating course content to ensure that students will be prepared to make sense of data that they will be encountering to guide business decision making, transitioning from having students merely learn a statistical procedure to problem solving and the changing role that introductory statistics courses play in a business program due to the rising use of business analytics. Audience members are encouraged to join in the discussion of these topics.

Session Description:

Pam Burch will present hand-on activities to reinforce concepts when teaching business statistics. She will specifically address the challenges of incorporating activities when teaching in large classes. She will share high-impact, low-cost activities which have worked successfully while using minimal class time. These will include:

- taking a sample from a bag of candy and weighing it (introduces sampling and bias),
- using post-its of different shapes to make histograms, dotplots and stem and leaf plots,
- using post-its to illustrate the birthday problem,
- using bags of pennies to create sampling distributions for proportions (a prelude to simulation and randomization tests),
- the bb-bucket to create confidence intervals for proportions.

Kim Melton Kim Melton will address some of the ways that the rising use of business analytics has changed the role that introductory statistics courses play in a business program – and the associated practical and ethical issues this introduces to the design of course delivery.

Weiyong Zhang will discuss, “How can we help students make a smooth transition from merely learning a set of statistical procedures to problem solving so they are enabled to apply academic skills to real problem solving?”

Ben Marlin will discuss, “How do we take the business student without a background in probability from the basic understanding of descriptive statistics through inferential statistics, to statistical models while enforcing the importance of the math and still providing the competencies with software...in one semester?”

Putting Neuroscience into the Business Curriculum

George S. Lowry¹, Catherine L. Franssen², Charles D. White², Paul T. Barrett², R. Adam Franssen²

¹Randolph-Macon College, Ashland, Virginia; ²Longwood University, Farmville, Virginia

In much the same way the study of international topics came into the business curriculum, so is the field of neuroscience. In the 1980s, emphasis on the ways social, cultural, and economic factors were influencing worldwide commerce brought about curricular changes, first by a single chapters in textbooks, then more fully into semester-long courses subsequently demanded complete texts. Now, whole programs are built around the study of international topics, some of which are highly specialized. Neuroscience research and applications are of great interest in the popular press and increasingly in academic programs beyond the disciplines that define the science itself. Following an evolutionary path of its own, studying human behavior has progressed from empiricism to one that connects observed behaviors to biologically measurable conditions, particularly with regard to the brain. Functional magnetic resonance imaging, transcranial magnetic stimulation, EEGs, biometrics such as facial recognition, eye tracking and hormone measures, and others allow for fuller explanations of these behaviors. Given its long history of behavioral research, it is not surprising, then, that economics, business, and the allied fields are seeking ways to incorporate neuroscience into their programs.

This paper examines two key elements. Tracing the fields of research and resulting academic disciplines will provide an important understanding of where the field has come from and where it is likely to go. Challenging traditional assumptions about the rationality of how and why decisions are made led researchers to explore anomalies in decision-making behavior. Their departure from the established theoretical conventions was identified by naming their fields “behavioral economics” and “behavioral ethics”, although the inquiry and application was not limited to just these two. As neuroscience has been able to add to the understanding of the brain, the behavior-brain connection has led some of those original disciplines to emerge as neuroeconomics, neurofinance, neuromarketing, neuroethics, neuromanagement, and neuroaccounting, to name the most active. Secondly, this paper provides a proposed way to engage business faculty in neuroscience. The starting point is a workshop where faculty can be exposed to some examples whereby they may find connections to their own field of interest. Facilitated by established resources such as chapters in extant textbooks (or indeed whole textbooks), readers, articles, syllabi, and course descriptions, faculty can proceed to explore opportunities to integrate neuroscience into their own courses or programs. Additional support will be required from neuroscientists to provide a basic understanding of the nervous system, particularly the brain, leaving the depth of coverage to the needs of the business faculty member and the discipline they wish to explore. While it is true there will be new material to learn, both inside and outside the business discipline, the study of business will be influenced by the achievements of neuroscience research and the market will expect graduates to be prepared in this area.

ENHANCING THE ONLINE COURSE EXPERIENCE: THE CASE FOR SYNCHRONOUS DISCUSSIONS

William “Rick” Crandall, School of Business, Post Office Box 1510, University of North Carolina at Pembroke, Pembroke, NC 28372, (910)-522-5786, rick.crandall@uncp.edu

Melissa Mann, School of Business, Post Office Box 1510, University of North Carolina at Pembroke, Pembroke, NC 28372, (910)-775-4608, melissa.mann@uncp.edu

ABSTRACT

There has been a marked increase in the number of e-learning programs being offered at higher education institutions. Despite the increase in online program utilization, there is still a paucity of literature offering a perspective on how to maximize student learning during such initiatives. This paper advocates using synchronous chats in an effort to increase student interaction, engagement, and social presence. This paper will provide a brief background on the need for cultivating social presence and interaction in an online course. An examination of the advantages and limitations of asynchronous discussion formats are delineated. The rationale for using synchronous discussion as the primary discussion tool for an online class is provided. The paper concludes with best practices that can be implemented before, during, and after a synchronous discussion.

INTRODUCTION

As online classes become the new higher education norm, many educators are confounded about how to ameliorate student engagement in their online courses. At the heart of the matter is how to make the online discussion exchange a more meaningful learning experience. A major concern is that asynchronous discussion boards have limited functionality and do not necessarily facilitate a communication exchange process that results in a meaningful discussion. The standard protocol in many online courses is that students are instructed to make a comment on the discussion board and, in turn, comment on what several other students have posted. Using this approach limits what the students are really learning as they are, seemingly, only regurgitating information from the class textbook and becoming proficient at commenting on other students' comments.

To address this dilemma, some educators have implementing synchronous chats into their online courses. The goal of such initiatives has been to facilitate a more meaningful discussion experience for both the students and the instructors. However, the implementation of said learning initiatives is not always a simplistic process; technology has to be adopted and learned, time has to be allotted for holding the discussions, and a commitment has to be made to persevering through set-backs to make the process work. Furthermore, despite the inherent benefits that change can bring, some students initially are wary of anything outside of the traditional online norm.

The present study advocates using synchronous chats in an effort to increase student interaction, engagement, and social presence. This paper will provide a brief background on the need for cultivating social presence and interaction in an online course. An examination of the

advantages and limitations of asynchronous discussion formats are delineated. The rationale for using synchronous discussion as the primary discussion tool for an online class is provided. The paper concludes with best practices that can be implemented before, during, and after a synchronous discussion.

BACKGROUND

“Online teaching is here to stay” [4: 112]. This particular sentiment is evidenced by the fact that more and more colleges and universities are adding online courses to their curriculum each semester. Henceforth, an imperative question will be how to increase the effectiveness of online courses so that students enjoy their experience (retention increases), acquire knowledge (assurance of learning), and have the wherewithal to use their new skills (transfer of training). One area of focus that can address these said issues is maximizing the value of the online discussion experience.

The Case for Social Presence

A major challenge for students in online courses is their lack of social presence in the course [11]. This challenge manifests itself in at least two ways. First, the student does not feel like they are part of a learning community, and second, the student does not sense the presence of the instructor in the course. The result can be a feeling of isolation on the part of the student [13]. Various dysfunctional outcomes have been noted with isolation in an online class including the student not wanting to persist in the online course [10] [30]. As a result, retention and graduation rates tend to be lower for online students vs. traditional face-to-face students [27].

In this vein, a major challenge in online education is to increase the social presence of students in an online course. In fact, student persistence has been found to increase as student presence in the course is increased [21]. Increasing social presence in the course means that interactions need to be cultivated among the course stakeholders, mainly, students, the instructor, and the person taking the course. There are various taxonomies of interactions that need to be understood and taken into consideration while facilitating an online experience.

Three Types of Interaction

Inherent in the development of social presence is the need to foster interaction. In one of the earlier research pieces on online education, Moore [24] identified three types of interaction: 1) student to instructor, 2) student to learning materials, and 3) student to student.

- *Student to instructor* – this interaction represents a dyad between the student and instructor which encourages feedback patterns between the two parties. The tone can be conversational, as in the case of advising the student, or it can be formal, as when the instructor and student are discussing feedback from an exam. In short, the student must be able to perceive the instructor is a real person and is active in the course [14].
- *Student to the learning materials* – this interaction focuses on the ways students access, manipulate, synthesize, and communicate content materials [5].

- *Student to other students in the course* – this interaction centers on students and their peers in the course, particularly in regards to how they represent a learning community [7].

In order for a student to do well in an online course, all three levels of interaction must be healthy and vibrant [7]. In an online course, this is especially important to note because online education may neglect “student to student” learning out of concern for convenience, both to the instructor and to the students. Hence, some avenue for small group learning involving student to student and student to instructor discussions is ideal for student achievement to be enhanced [5] [22].

The level of interactions, especially among student to students, and students with their instructor help foster a sense of social presence. Clark and her colleagues [11] noted that students were more likely to stay in a course when their feelings of social presence increased. Indeed, this is important because attrition is higher among online students vs. face to face [15] [21] [27].

This paper focuses on the small group interactions that can take place in an online course through synchronous discussions. While asynchronous discussions can also be used in small group interactions, it is important to elucidate on the merits of synchronous discussions as they have the advantage in promoting social presence and interaction. Both forms of discussion offer their own unique set of strengths (affordances) and limitations (inhibitors). These attributes are juxtaposed in the next two sections as a case for synchronous discussions over asynchronous venues is outlined.

ASYNCHRONOUS DISCUSSIONS (AODS)

Asynchronous discussions utilize a discussion board where the course instructor posts questions or comments. Students respond to these posts and often comment on what other students have posted on the topic.

Strengths of Asynchronous Online Discussion (AOD)

Asynchronous online discussion (AOD) boards offer notable advantages to the online course. First, since all postings are done asynchronously, there is the time convenience factor for the student, who can post anytime they want during a pre-specified period of time. In addition, opportunities for deep thinking are available in an asynchronous environment due to the time for reflection [9]. Another set of advantages associated with AOD involve the nature of writing the comments. Students posting their comments get practice in writing, spelling, and grammar skills [3] [9] [18].

Limitations of Asynchronous Discussion Boards

One of the main weaknesses of asynchronous discussion boards is the lack of audio and visual cues from other discussion members [1]. At best, a photo may show up next to a post if the instructor has enabled that tool. A second disadvantage is that the time needed to complete the discussion (or the task, if one is assigned) is longer than in a synchronous environment [35]. This is especially true when a problem has been directed at a team of students who have the charge of solving the problem [1].

Another problem with asynchronous discussion boards is the amount of written text that accumulates as a result of the discussion. Students may find it cumbersome to sift through the many lines of text in order to make sense of the discussion thread [29]. Furthermore, the instructor who is assessing the progress of a virtual team may become overwhelmed by the amount of text that needs to be reviewed [2] [16].

The nature of an asynchronous discussion results in conversations that are constantly starting and stopping, hence, it takes longer for decisions to be made and consensus to be reached [28]. Ironically, the slowness of decision making in an asynchronous environment allows participants to take more time for reflection and writing out substantial messages [19] [36].

THE CASE FOR ONLINE SYNCHRONOUS DISCUSSIONS (OSDS)

Synchronous discussions can offer a viable alternative to asynchronous discussion boards. Synchronous discussions are held in real-time, with the instructor present virtually, with or without a video connection, and with a free exchange of information and files available during the duration of the discussion. Synchronous discussions can occur in three forms including text chat, voice conversation, and video discussion. The various benefits and limitations of OSDs are discussed next.

Strengths of Online Synchronous Discussion

The main advantage of an OSD is that conversations are conducted in real time, often with cameras displaying the person who is talking but can also include a visual of all participants during the entire course of the session. This feature gives the online course a more “human” effect, which can build social presence as well as an enhanced feeling of involvement on the part of the student [34]. Another advantage of synchronous communication, particularly when there is a camera on the participants is that communication is enhanced [31]. The improvement in communication also enhances collaboration and interaction among the students and the instructor, as well the social presence experienced.

In regards to debating a topic posed by the instructor, OSD allows participants to discuss the topic without an interruption to the flow of the conversation [36]. Since feedback from other students and the instructor is in real time, motivation and learning can occur on the part of the student [32]. In addition, critical thinking of the topic can occur if the instructor is skilled in asking the right questions [8] [36].

Limitations of Online Synchronous Discussion

There has been some debate on the merits of OSD. Some research indicates that OSD is a good social facilitation tool [26], but not necessarily an acceptable teaching tool [33]. Cunningham, Fagersten, and Holmsten [12] postulate that synchronous discussions are preferred by students confident with their communications skills and able to think quickly. Whereas, students who speak English as a second language or not as equipped to think expediently may show a preference for asynchronous learning experience [12]. However, one could argue that a student

could benefit greatly from increased exposure to a skill area that they perceived to be incompetent at or is actually lacking.

One important limitation that every OSD instructor should be aware of is the need to hold multiple-sessions [5]. This is necessary because in an online class, it is virtually impossible to find a common time where every student can meet. Furthermore, the size of the discussions need to be kept to an acceptable count so that everybody in the session can contribute in a meaningful way. Based on experience hosting OSDs, it is suggestable that multiple sessions need to be set up in these classes so that all of the students can be accommodated.

Another limitation of OSD is the technology problems that can occur before or during a discussion [5] [17]. Problems may occur to the whole group of students, as when the server goes down at the university level; or it may involve individual students who have difficulty making a reliable connection to the discussion. Some interface software programs are less susceptible to these types of issues and many of these issues may become a non-issue as technological advances in this area continue.

BEST PRACTICES FOR ONLINE SYNCHRONOUS DISCUSSIONS

For the context of this paper, OSD is being used exclusively to reference discussions involving the students and the instructor. Therefore, OSD is viewed as a substitute for AOD discussion boards. There are certainly other uses for online synchronous activities. Gedera [17] documents how students gave verbal presentations to the rest of the class in an online synchronous course. In addition, instructors can hold office hours and use a white board to explain concepts to inquiring students. Some faculty even use the synchronous chat tool to deliver real-time lectures.

In the discussion that follows, current best practices for incorporating OSD into an online course are disseminated. The planning strategy taken here is to look at best practices that should occur before the discussion session, during the session, and immediately after an OSD is over.

Before the Discussion Session

1. Determine the learning objectives for the discussion.

The first step in designing an effective OSD is to state the learning objectives for the session. These objectives should also tie in with the learning goals that have been set up for the course learning module. Instructors should remember that the discussion is a time to promote critical thinking of the subject under discussion. In addition, there will be secondary goals of building community and promoting social presence on the part of the students and the instructor. Hence, questions and supporting activities should be designed to achieve these goals.

2. Compose the questions that will be asked during the discussion.

The next step in designing an OSD is to develop specific questions that support the learning objectives [6]. The types of questions used should focus in eliciting higher level learning goals. Table 1 illustrates the type of questions that could be asked in an organizational leadership course using Bloom's revised taxonomy as a framework.

Table 1 – Potential Questions for an Organizational Leadership OSD Based on Bloom’s Taxonomy

Bloom’s Taxonomy	Potential Questions
Evaluation – the ability to judge the value of material for a given purpose based on a definite set of criteria.	Evaluate the merits of an employee improvement plan that has just been proposed by a front-line supervisor.
Synthesis – the ability to put parts together to form a new whole.	Develop an improvement plan for an employee who is constantly late for work.
Analysis – the ability to break down a complex problem into different parts and to determine the relationships among those parts.	Identify the key factors in a case study of a company which point to why that company is performing poorly.
Application – the ability to use learned material in new and concrete situations or to demonstrate the accurate use of a concept or theory in a different context.	Apply the facets of goal setting theory to a person who wants to lose weight by the time their high school reunion is held.
Comprehension – the ability to grasp conceptual meaning.	Compare the strengths and weaknesses of equity theory with those of expectancy theory.
Knowledge – to define, memorize, and remember previously learned material such as common terms, specific facts, and basic concepts.	Identify the three main components of Fiedler’s Contingency model?

Sources – [10] [25]

A variation of potential questions that can be asked during a discussion is offered in table 2. Here, the aim is to follow a sequence of questions that begin with an open-ended question. Such a question makes a good starting inquiry because it challenges the participants to answer from the various perspectives represented by the discussion group members present [36]. Open-ended questions will lead to a second set of questions, comparison questions, which serve to compare items that have been raised by the open-ended questions.

Probing questions are asked in a follow-up to comparison questions. Problem questions are designed to get the student to think deeper about their viewpoint. Finally, synthesis questions complete the cycle of questions for the particular topic under study. These synthesis questions are designed to get the student to summarize their final thoughts on the subject by taking into consideration the other viewpoints that have been offered. Table 2 summarizes the discussion thus far.

Table 2 – Four Types of Potential Questions to Ask in an OSD

Type of Question	Purpose of Question	Potential Question
Open	Promote student participation.	Which leadership style do you think you are in a high-stress situation?
Comparison	Provoke intellectual thinking by getting students to evaluate various options.	Which leadership style do you think would work best in this particular situation?
Probe	Promotes knowledge construction by getting the student to think deeper on a single topic.	Why do you think this particular leadership style would not work in this situation?
Synthesis	Promotes knowledge construction by getting the student to summarize and form an opinion, stance, or conviction.	How would you lead a change strategy in an organization that had many employees who had been there 15 years or more?

Source – [36]

3. Set up a practice session.

Before the first OSD is held, it is highly recommended that a practice discussion session be scheduled enabling the students and the professor to establish a reliable connection with the appropriate discussion tool software. There are some software tools that are linked through the course management system (CMS) while others reside outside the CMS. For example, Blackboard utilizes Collaborate (formerly Elluminate Live) as its OSD provider, but Webex is a standalone program.

4. Schedule multiple sessions in order to get all or at least most of the class involved.

For most classes, it will be necessary to set up multiple sessions that meet at different times so that students on various schedules can be accommodated. In addition, multiple sessions are needed to keep the number of discussion participants at a reasonable level within each session. There may be some students who cannot attend a discussion session either because of scheduling problems or bandwidth resource limitation. For these students, an alternate learning activity will need to be substituted for the OSD [5].

During the Discussion Session

The instructor should determine the goals for each discussion session. In particular, the specific cognitive skills and processes that you want the group to be engaged in should be identified [10]. Then, list a series of questions that will facilitate the attainment of these goals.

1. Ask open ended dialog questions that are designed for discussion.

The key to holding a good discussion is to ask questions that are open-ended and require the student to think about their answer. Following one or both formats offered above are encouraged as best practices. The skilled instructor needs to be proficient at asking the right type of follow-up questions in order to keep the discussion flowing [23]. In addition, the instructor should avoid the temptation of turning the discussion into a lecture, which can happen very easily. Allow the students to apply course content to their lives and reflect on experiences or potential situations wherein these concepts are applicable.

2. Use extended wait times after asking a question.

There is a tendency on the part of some instructors to try to rush the students to answer questions. When there is a period of uncomfortable silence after a question has been posed, the impatient instructor may answer their own question instead of waiting for the student to respond. In cases like these, it is recommended that the instructor simply wait a few seconds longer for the answers to come [10]. Alternatively, the instructor can rephrase the question to clarify any misunderstandings and elicit participation. If all else fails – the instructor can call on someone.

After the Discussion Session

1. Assign a grade for participation (using a rubric).

In order to promote participation in the OSD, it is recommended that a rubric be developed to grade each participant in the discussion [5]. The rubric need not be complicated but it should emphasize what the instructor deems to be important in contributing to the discussion. Once the discussion is over, it is best to assign a grade for each participant in the session. The information is still fresh in the instructor's mind and grading will be easier and more valid. One feature of an OSD is that the instructor does not have to read multiple lines of text written by students. Instead, a grade is assigned immediately after the discussion based on the student contribution as indexed by the pre-existing rubric.

2. Archive the course

The discussion sessions can be saved and archived so that students who missed the session can listen to them at a later date. Educators should be mindful of the interface program they select to ensure it contains such features.

3. Assemble feedback materials and incorporate continuous improvement into the next chat.

At the end of the semester, the use of a student survey is recommended to determine what the students felt were the desirable attributes and the areas in need of improvement. Several open-ended questions can be used such as, "Please list your suggestions for improving the course and/or the instructor's teaching style and methods" [5]. Another potential open-ended question that has been utilized in the past is, "What suggestions can you provide to improve the online discussions?"

Most course management systems (such as Blackboard) have an assessment tool that includes a survey option. Surveys typically collect data without revealing the name of the individual student. This point should be emphasized in the directions as students will provide more candid feedback knowing their responses are anonymous.

Reviewing this student feedback data can become part of the school's assurance of learning program. When student responses point to changes that need to be made, then the school (the instructors who deliver the course) can document these changes and then re-survey at a later date to see if the attainment of learning goals has improved.

CONCLUSION

An online course should provide opportunities for students and the instructor to engage and interact in a meaningful way. When effective engagement takes place and the need for social presence is satiated, the risk of losing a student goes down because student satisfaction goes up. Inherently, the students in the course must sense that their instructor is a "real" person in the course [5] [20].

The use of synchronous chats led by the instructor can increase said engagement in online courses. Henceforth, the motivation to use this tool is ultimately to improve the learning experience of the student. Synchronous chats enable the instructor to make the online course more captivating because of the use of real-time discussions. Without such interactions, online courses risk becoming correspondence courses whereby students simply read materials, watch a video, and then take a test. While correspondence courses do have a role in some venues of education, they fail at providing opportunities for students to interact and improve desirable soft skills such as interpersonal communication. Correspondence classes and those solely using asynchronous learning experiences, are less likely to facilitate student engagement and the social presence needed to make the course an effective and enjoyable learning experience.

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**REVITALIZING THE CAPSTONE EXPERIENCE:
SYNTHESIZING STAKEHOLDER NEEDS WHILE SUPPORTING THE MISSION**

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By

J. Kay Keels, Ph.D.
jkeels@coastal.edu
843-349-2688

Janice A. Black, Ph.D.
janblack@coastal.edu

Nicholas D. Rhew, Ph.D.
nrhew@coastal.edu

**Department of Management and Decision Sciences
E. Craig Wall Sr. College of Business
Coastal Carolina University**

Abstract: Three key overlapping components of the discussion will be the Strategic Management course, the College's mission, and the needs of today's Millennial Generation students. First, the requirements of the mission are examined carefully to clarify the specific demands imposed on the business curriculum. Next, the key characteristics of Millennial Generation students -- both positives and negatives -- are examined to point out the learning needs of these students and to demonstrate how the senior capstone course addresses these needs. Finally, the discussion turns to possible options for adapting the capstone experience from one course to a portfolio of course options designed to meet these needs more effectively. This discussion is based on the experience of a college of business administration in a mid-sized university located in the southeastern United States.

Distributed Workforce Issues: Communication and Work Relationships

Richard W. Monroe

James C. Haug

Longwood University, College of Business and Economics, Farmville, VA 23909

Email: monroerw@longwood.edu

ABSTRACT

In many organizations, a highly skilled workforce represents a strategic advantage and an extremely valuable resource. In today's business environment, organizations have adopted new workforce arrangements in order to acquire the number of skilled workers that is needed to support their mission. One such arrangement is the distributed workforce. The characteristics of the distributed workforce will be described and then this paper will explore employee perceptions about the work environment, communication methods, technology use and the need for workforce relationship building within one U.S. agency which utilizes a distributed workforce.

Introduction

A distributed workforce may be composed of teams or individuals performing project-oriented tasks where all tasks ultimately need to be completed to achieve an overall objective for the group. In this context, the workforce will be composed of some combination of colleagues working from remote locations and team members who are physically collocated in the same facility. For example, "these team members may be members of the same organization; in other cases, collaboration or outsourcing involving different organizations may exist" (Jiménez, et al., 2009).

Software development and other similar product development projects utilize a distributed workforce approach with employees located in many locations around the world (Gupta, et al., 2009; Thissen, et al., 2007; Saxena and Burmann, 2014). Team building, team performance, and knowledge sharing across the entire team are just a few of the issues addressed by prior research

(Gupta, et al., 2009; Thissen, et al., 2007; Saxena and Burmann, 2014). The normal worker interaction may not be possible and "...interaction between members requires the use of technology to facilitate communication and coordination" (Jiménez, et al., 2009). The virtual nature of distributed teams has also raised concerns about the barriers to communication which include the lack of facetime and a lack of professionalism in the communications that do occur (Thissen et al., 2007).

The focus of this paper will follow in a similar stream to explore communication and relationship building within a distributed workforce that is very dependent on technology for sharing critical information. Organizations may also have dispersed activities across the entire country to conduct their domestic activities.

Most organizations in today's environment are interested in leveraging technology for optimal use of both traditional and distributed segments of the workforce. Decision makers are now dependent on the optimal use of technology by a workforce that is hosted both in traditional office settings and in a virtual environment. Also, younger additions to the workforce are more apt to be more comfortable with electronic exchanges and engagement, and often prefer it to face-to-face dialogue and associated non-verbal cues and feedback. However, with a goal of forming strong bonds in relationships within the employed workforce and with customer clients, the impact on development of resilience and engagement may tend to become secondary in importance, with possible adverse consequences. The establishment of trust and rapport may be reduced, thus resulting in a less effective organization and reduced job satisfaction.

The Office of Operations Research and Resource Analysis (DORRA) within the Defense Logistics Agency (DLA) is the organization of interest in this study. DLA is an agency in the U.S. Department of Defense, with more than 26,000 civilian and military personnel located in 48 states and 28 countries. DORRA is the DLA Center of Excellence (COE) for strategic analysis across the enterprise and serves as an in-house consultant providing insights to facilitate senior leader decisions on issues of greatest importance. This effort supports DLA Strategic Plan 2015-2022 and Goal Area 2: People and Culture. Other large private and public institutions may also benefit by the findings and results.

Research Commitment

DLA historically has had a strong interest in measuring and gauging trends within its workforce, and conducts bi-annual cultural surveys on many aspects of performance and satisfaction. The agency uses the results to help shape adjustments to goals and priorities, as well as areas that leadership can emphasize for enhanced training and focus. Workforce resilience is one of the primary areas of focus, with a desire to helping people become engaged with each other in an effective way. The objective of the study is to identify key issues and attitudes related to technology's impact on organizational effectiveness, as well as techniques and tools that may help to enhance the work environment.

Research Plan

A more extensive literature review will be conducted, seeking relevant academic and professional journal articles about the topic. Next, a focus group will be conducted with a diverse mix of DORRA participants to explore key factors and issues present in the current workplace. Based on the results of the focus group and literature review, a survey instrument may be created to address important aspects of the research agenda. The survey instrument would be pre-tested to help reduce ambiguous wording, promote clarity, and enhance instructions. The approved instrument will then be administered to all DORRA employees (approximately 60) using Survey Monkey software launched from a DORRA email account, with sponsorship clearly identified as the Longwood as an "honest broker" for data analysis and findings. A key goal of the project is to achieve a response rate of at least 70%, which would be similar to response rates of past agency-wide DLA culture surveys. Participants will receive a summary of the study's results at a future date. The survey data will then be tabulated, analyzed and summarized by Longwood, which will then present the findings to DORRA for review and comment. A final report will then be drafted and submitted to DORRA for review. Pending DORRA's approval, the Longwood faculty would submit the findings as part of competitive paper to the Southeast Decision Sciences Institute.

Anticipated Results

The primary stakeholders for this project are the immediate DORRA staff participants, as well as DORRA leadership. Ultimately, the study could be expanded to a wider segment of the DLA workforce, or become an integrated segment of the bi-annual agency wide culture survey. The study could also be expanded to other stakeholders within DLA's client base, or internally to DLA's employees. Findings may help to add additional items to DLA's resiliency toolkit, which is used to help build relationships within the agency. Findings may also surface ways to enhance the effectiveness of the workforce, to establish guidelines and norms about the use of technology and electronic devices, and to point out ways to build trust within the workforce and with customers.

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Leadership from Europe's Powerhouse: An Exploratory Study

Amit Shah
Frostburg State University, USA
101 Braddock Road,
Frostburg, MD 21532
ashah@frostburg.edu
301.687.4408

Michael Monahan
Frostburg State University
101 Braddock Road,
Frostburg, MD 21532
mmonahan@frostburg.edu
301.687.3090

Leadership affects every aspect of a human's everyday life. According to Peter Drucker, management expert, "Above all, the performance of the managerial leadership determines the success or failure of the organization." Leadership skills and abilities can be taught and developed especially in academic institutions. The present study utilized Bolman and Deal's four frame model to gain insights into the preferred leadership style, and also to identify areas for development in German students. The sample was comprised of 60% females and 40% males. Since 96% of the students were Business Majors, the researchers subdivided the sample as management majors and other business majors. Interestingly this breakdown resulted in a 50-50 split. Even though this sample of students was remarkably homogeneous there some statistically significant differences were found. A full fifty percent of the respondents did not employee any specific leadership style while thirty percent used the single style, and sixteen percent the paired style. The Human Resource Frame was consistently the strongest while the Political frame was the weakest. Developmental suggestions and recommendations are offered by the researchers.

REGULATORY DISRUPTION RISKS FACING SUPPLY CHAIN MANAGEMENT

Nihar Kumthekar

Student-PhD- Logistics and Supply Chain Management

College of Business Administration

Georgia Southern University

Statesboro, Georgia-30458, PO Box 8151

Tel: 912-996-0015

nk00945@georgiasouthern.edu

Mohammed Anas Irfan

Student-PhD- Logistics and Supply Chain Management

College of Business Administration

Georgia Southern University

Statesboro, Georgia-30458, PO Box 8151

Tel: 912-481-3210

mi00536@georgiasouthern.edu

ABSTRACT

Supply chain uncertainty, risk and disruption have emerged in the last decade as an important avenue for research. Changes in regulation related to trade, business, environment, health and safety, security, and fiscal policy have become sources of risk for businesses operating globally. In spite of being labelled as an indirect risk, regulation change seems to be one of the major causes of disruption for many supply chains today. Even if they do not immediately impact supply chains- given the nature of regulation change, they still can cause organizations to rethink their supply chain policies for the short as well as the long term. Given the importance of regulatory uncertainty, risk and disruption, one would expect to find structured research that clearly defines and demarcates them from other uncertainties, risk and disruption. However this is not the case. Our paper tries to lay down some ground work in what constitutes regulatory risk through a review of literature and its analysis using a thematic and longitudinal perspective. It was found that there are certain classification structures that are prevalent across literature for regulatory risk- however, further work is required to understand the effects of regulation change on supply chains. A gap was also identified with respect to the methodologies used in research that covers regulatory risk and more longitudinal studies have been proposed.

INTRODUCTION

The threat of supply chain disruption is considered by many to be the most pressing concern of firms operating in today's global marketplace [7]. Thus, the need to identify and manage supply chain related risks is of utmost importance to supply chain executives [17] [31]. This increased industry focus on supply chain risk identification and management has also prompted significant scholarly interest [24][31].

As part of this increased scholarly interest, many supply chain researchers have sought to define supply chain risk and categorize different types and sources of supply chain risk (e.g. [14][32][4][18]). Some supply chain researchers have sought to create frameworks to assist managers with the identification of supply chain risks (e.g. [24]). Still other scholars have opted to focus on specific types of supply chain related risk. For example, Zsidisin defined supply risk and provided insights into the managerial perceptions of supply risk [45][46].

This research seeks to draw from these previous investigations in hopes of drawing increased attention to another specific type of supply chain risk, regulatory risk. By regulatory risk, this research is referring to the supply chain related risks associated with or created by government activities or actions. These risks are proving increasingly challenging for supply chain managers. For example, in America, many in the transportation industry argue that changes to the Hours of Service (HOS) regulations, which were implemented as a part of an effort to improve the safety of motor transportation, have made drivers less productive and thus placed increased pressure on an industry already struggling to maintain a sufficient number of drivers [13].

Regulatory changes can lead to disruptions of those businesses who's operations are specifically concerned with logistics and transportation. However, these disruptions have far reaching consequences - as other industries like retail and manufacturing are heavily reliant on logistics service providers for ensuring the smooth movement of goods in their global supply chains. Thus, regulatory changes can lead to disruptions in the daily and strategic operations of global supply chains.

There seems to be a lack of clarity in the existing literature on what 'regulatory disruptions' actually means and what constitutes 'regulatory disruptions'. The term 'regulatory risks' and 'regulatory disruption' has been used by authors to describe disruptions caused by regulatory changes. As will be discussed in detail later, there is no prior literature or journal articles based exclusively on defining and classifying regulatory risks and disruptions in supply chains. However, various typologies have been proposed to describe the different types of risks and disruptions, covering the effects of regulatory disruptions under the themes of environmental risks/disruptions, fiscal risks/disruptions, policy risks/disruptions and political risks/disruptions. This paper is an effort to review literature that talks about what regulatory disruption actually constitutes rather than focusing purely on the disruptive effects of different regulations on supply chains.

METHODOLOGY

Objective

The study was carried out with a view to understand the current state of research with respect to disruptions associated with regulatory change. In order to achieve this, it was decided to break down the issue into two objectives:-

- a. To understand how current literature defines and classifies regulatory supply chain disruptions and risk
- b. To identify future agendas in regulatory disruption and risk

Data Collection

To understand the current state of uncertainty, risk and disruption research in business management and supply chain, definitions are insufficient. To bring in a distinct understanding of their structure, it is important to understand their typology- specifically related to business, supply chain and regulations. Understanding the existing typologies would give a fair idea of the underpinnings of the concept. Unlike generic uncertainty, risk and disruption literature, the specific body of literature relating to the classification of regulatory uncertainty/ risk/ disruption in supply chains is scarce - with just references to it being mentioned. Though regulatory uncertainty/ risk/ disruption has been defined, if one would look at the typologies of uncertainty/risk/disruption, one would wonder whether regulatory risk exists under political risks, social and economic risks, policy risks among others.

As one of the goals of our research is to create a base for further research on regulatory uncertainty/ risk/ disruptions through a review of literature, we have

- Consolidated the literature pertaining to those classifications and frameworks (of uncertainty/ risk/ disruptions) which cover regulatory risk / uncertainty / disruptions.
- Reviewed literature that analyses the major themes covered by literature that discusses regulatory uncertainty/ risk/ disruptions along with a longitudinal analysis of such literature.

Through such a review, we seek to ascertain whether there are any patterns present that can help ground future research.

Three separate searches were carried out. These were:-

1. Search using the search operators: "supply chain" AND regulat* AND (risk OR disruption).

This search was carried out using the EBSCOhost database services against specific leading journals (the names of all of these journals has been provided in Appendix 1) relating to logistics and supply chain management. This list was derived from the one in Wowak and Boone [43]. However, the journals International Journal of Quality Science, Journal of Business Logistics, Journal of Purchasing & Supply Management, Operations Management

Research, and Supply Chain Management: An International Journal, were not part of the EBSCO search database and could not be queried. The search was run against the remaining journals individually. The first of the two articles obtained as an outcome of this search was related to the role of regulatory focus theory and the level of risk and uncertainty on decisions related to mitigating/avoiding supply chain disruptions. The other search result was a journal article that modeled the effects of non-tariff barriers supply chain and procurement decisions. Thus, both of these articles were tangential in terms of their coverage of the research topic.

2. Search using synonyms or replacements to words in search 1:

Given the fact that there were no relevant search results with our initial search, a number of words that may act as synonyms or replacements to the words in the initial search were derived and the search was run once again with these new words (which have been detailed in Appendix 2). This constituted the second search effort.

As it can be seen from Appendix 2, this search had three sets of words. The first set related to words that may be related to regulations. This set was used to search both the titles and the abstracts of journal articles. The second set related to words that relate to supply chains. This set was used to search the titles of journal articles. This set was further broken down to down to two subsets: one related to words that are related to firms as a whole (at the macro level) and the other related to specific functions within these firms (at the micro level). These subsets were then used to search the abstracts of each journal article. This approach of dividing a set of words into subsets was taken to narrow down the search results and on the premise that any article relating to supply chain management will refer to both the firms and their respective functions in the abstracts. A third set of words relating to risks and disruptions was also used but it was treated as secondary list of words and, therefore, only used to search the abstracts of journal articles.

This second search resulted in forty four search results (after removing duplicates). However, after sifting through the abstracts for relevant documents, this number was further reduced to twenty six articles. Detailed reading of these articles showed that most of the articles weren't focused specifically on regulatory risk and disruption but were tangential. Similarly, there were some articles that talked about the effects of regulations on supply chains but were either in the form of particular real-life cases or scenarios -where businesses were facing regulations, or modelled or highlighted the decisions that were needed to be taken to mitigate or prevent certain effects of regulations. Some articles even related to modelling the effects of regulatory change and, finally, one related to the need for regulations in response to supply chain disruptions.

On the basis of the aforesaid search outcomes, it was apparent that there was no single piece of research that has been done on regulatory disruptions and risks for supply chains that detailed definitions, typology and avenues for further research. To further corroborate this, two basic searches on Google Scholar with the search strings 'regulatory risks supply chain' and 'regulatory disruptions supply chain' was carried out but, again, it did not reveal any directly relevant articles for the purpose of this study. However, it was seen that regulatory risks were frequently cited in risk management literature.

3. Search using references from highly cited articles:-

In order to achieve objective 1 and 2, nine recent and highly referenced articles on supply chain risk, supply chain disruption and supply chain uncertainty were identified. The list of these articles is provided in Appendix 3. A keyword search for words such as “regulation”, “regulatory”, “politics”, “policy”, “legal”, “environment” and “law” was carried out in each of these articles. If further relevant literature was found to be cited in these articles, it was retrieved and the same keyword search as mentioned above for the original (parent) articles was repeated for the new articles. This resulted in 27 relevant articles being found. Subsequently, information was gathered from each of the articles regarding existing typologies and examples related to regulatory disruptions/ uncertainty/ risk and was tabulated along with the methodology for that paper.

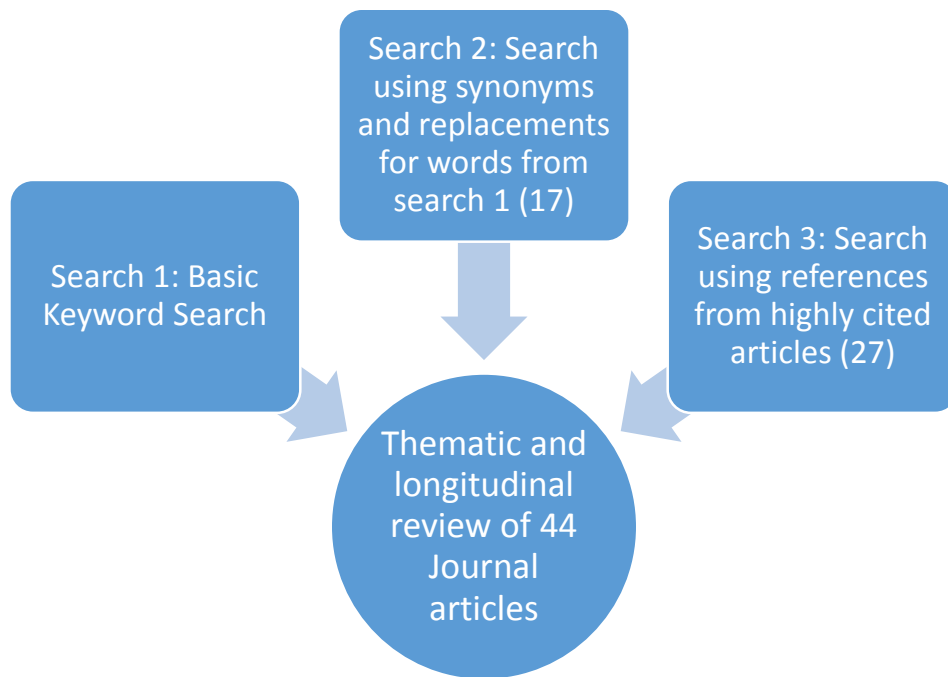


Figure 1. Literature review method

The findings are based on the review of the forty four articles which were used as a part of the literature review. These forty four articles were derived from the second and third searches.

FINDINGS

Position of regulatory risk/ uncertainty/ disruption in risk/uncertainty/disruption frameworks in current logistics and supply chain literature

The classifications proposed by various authors for uncertainty/ risk/ disruptions have been summarized in table 1. The first two columns of the table give the author name and the publication dates. The third column provides the base of classification as stated by the authors (i.e. uncertainty, risk or disruption). If any specific condition for this has been provided- for example, Spekman and Davis [32] specifically call it “risk in supply chain”, then this has been mentioned. The column “Typology followed” gives a brief list of classifications for the base with those classifications that relate to regulations based on the author’s coverage highlighted by a bold font.

Table 1. Classification of risk/ uncertainty/ disruptions that include regulation change as a source of risk/ uncertainty/ disruption

Author	Year	Risk/ Uncertainty/ Disruptions	Typology followed
Miller[19]	1992	Uncertainty	<ul style="list-style-type: none"> ● General Environmental → Political → Government policy → Macroeconomic → Social → Natural ● Industry → Input market → Product market → Competitive ● Firm → Operating → Liability → Research and Development → Credit → Behavioral
Smallman[30]	1996	Risk	<ul style="list-style-type: none"> ● Direct Impact-Human, Organization and Technology ● Indirect Impact- Regulatory, Infrastructural and Political
Zsidisin, Panelli and Upton [47]	2000	Supply risk	<ul style="list-style-type: none"> ● Design ● Quality ● Cost ● Availability ● Manufacturability ● Supplier ● Legal ● Environmental, health and safety

Harland, Brenchley and Walker [10]	2003	Risk	<ul style="list-style-type: none"> ● Strategic ● Operations ● Supply ● Customer ● Asset impairment ● Competitive ● Reputation ● Financial ● Fiscal ● Regulatory ● Legal
Spekman and Davis [32]	2004	Risk in supply chain	<ul style="list-style-type: none"> ● Associated with flows ● Associated with security ● Associated with opportunistic behavior ● Associated with Corporate Social Responsibility
Jüttner [15]	2005	Risk	<ul style="list-style-type: none"> ● Environmental-from external uncertainties → Political → Natural → Social ● Supply and, Demand-from internal uncertainties
Manuj and Mentzer [18]	2008	Risk	<ul style="list-style-type: none"> ● Supply ● Operational ● Demand ● Security ● Macro ● Policy ● Competitive ● Resource
Tang and Tomlin [33]	2008	Risk-Supply Chain	<ul style="list-style-type: none"> ● Supply ● Process ● Demand ● Intellectual Property ● Behavioral ● Political/ Social
Rao and Goldsby [24]	2009	Risk	<ul style="list-style-type: none"> ● Environment → Political uncertainty → Policy uncertainty → Macroeconomic uncertainty → Social uncertainty → Natural uncertainty ● Industry ● Organizational ● Problem-specific ● Decision-maker

Trkman and McCormak [36]	2009	Uncertainty (as a moderating variable)	<ul style="list-style-type: none"> ● Endogenous → Market turbulence → Technology turbulence ● Exogenous → Continuous → Discrete - regulatory change, man-made disasters, natural hazards
Schmidt and Raman [28]	2012	Disruption	<ul style="list-style-type: none"> Internal- firm and supplier related disruptions ● External to firm and supply chain (milder impact)- weather, government regulations, natural disasters, political turmoil
Cagliano, DeMarco, Grimaldi and Rafele [3]	2012	Risk	<ul style="list-style-type: none"> ● External → Catastrophic → Political → Economic → Social → Legal → Cultural ● Internal
Vilko, Ritala and Edelmann [37]	2014	Uncertainty	<ul style="list-style-type: none"> ● Substantive → Parametric → Structural ● Procedural

Political and policy risks are subset of general environmental uncertainties. Political risk can stem from uncertainties associated with major political changes. These could include regime changes as well as political turmoil [19]. Policy risks arise from instability in government policies that affect business communities [19]. Types of policy uncertainties includes “

- Unanticipated fiscal and political reforms
- Price controls
- Changes in level of trade barriers
- Threat of nationalization
- Changes in government regulation
- Barriers to earnings repatriation” [19]

Policy risks can also arise out of interactions between governments, banks and multilateral organizations like the International Monetary Fund. Provisioning of public goods by the government is also a source of policy risk. Risks associated with strikes and non-provision of a safe workplace can fall under the category of labor uncertainty. Liability uncertainties “are associated with unanticipated harmful effects due to the production or consumption of a company's products” [19]. Labor and Liability uncertainties- which are classified under firm uncertainties by

Miller [19] could also be caused due to regulatory changes. Input uncertainty – which is a subset of Industry uncertainty could be related to environmental uncertainties for example, input uncertainties caused due to ambiguities in multilateral trade agreements and political instabilities affecting production schedules [19]

Smallman [30] highlighted that regulatory and political risks can be considered as “crisis accelerators” and can be considered as indirect risks.

According to Zsidisin, Panelli, & Upton [47] Supply Risks can be classified into design, quality, cost, availability, manufacturability, supplier, legal and environmental, health and safety. Relevant to our paper are the legal and environmental, health and safety risks which cover import/ export restrictions, tax issues, and material safety compliance.

The risks affecting the supply network can include fiscal risk (due to changes in taxation), regulatory risk (such as environmental regulation) and legal risk (due to issues arising with customers, suppliers etc.) [10]. This article also emphasizes the risk associated with non-compliance –given that the outcome is known

Risk can also be linked to compliance. Compliance can also be a function of the perceived loss especially when dealing with environmental regulations [6]. In today’s globalized world, risks faced by organizations can stem from the non-compliance of their suppliers. For example, Gap is currently facing class action lawsuits for sweat shops being run by their suppliers[32].

Legal risks can include violation of rights, legal obligations of disclosure and intellectual property. Legal risks are at the organizational level [9].

Jüttner [15] classifies political and social risk as a part of environmental risk. Supply chain risk sources are defined in this paper as “variables which cannot be predicted with uncertainty and from which disruptions can emerge [15]. The study also found through their primary research that that socio- political risks (fuel protests of 2000 and September 11 terrorist attacks) created the largest “rippling effects” for the organizations that were queried along with their suppliers and customers.

The political factors that need to be taken into account include:-

- Stability of government
- Law and order
- Sanctions

Sources of risk can include Macro risks (“Economic shifts in wage rates, interest rates, exchange rates, and prices” [18]), Policy risks (“actions of national governments” [18]).

Tang and Tomlin [33] highlight the different sources of risk facing supply chains. They include Intellectual property risks and give the example of how absence or ambiguity or non-enforcement of IP –laws in China has allowed a supplier of New Balance shoes to create unauthorized products using virtually identical design and materials without facing any consequences [33]. They also highlight political and social risk as a type of supply chain risk and give the example of EADS- which is facing major production delay for the Airbus A380 due to the political wrangling about the work-share between the different euro states.

Oke and Gopalakrishnan [21] talk about the different sources of supply and demand risk. They identify man-made risks that include port lockouts (labor strikes) and terrorist activities as sources

of risk as they have affected the movement of goods leading to temporary but severe disruption of supply chains. An interesting observation was that regulatory changes could increase supply risks due to regulatory non-compliance by suppliers. Regulatory changes that might affect demand side risks include ban on certain ingredients. Government enforcement of safety regulations and actions by non-governmental bodies like PETA are identified as miscellaneous sources of risk [21]. We thus see that regulatory risk affects both the supply and demand side of the supply chain and have a medium likelihood with moderate impact on the supply chain (refer figure 2).

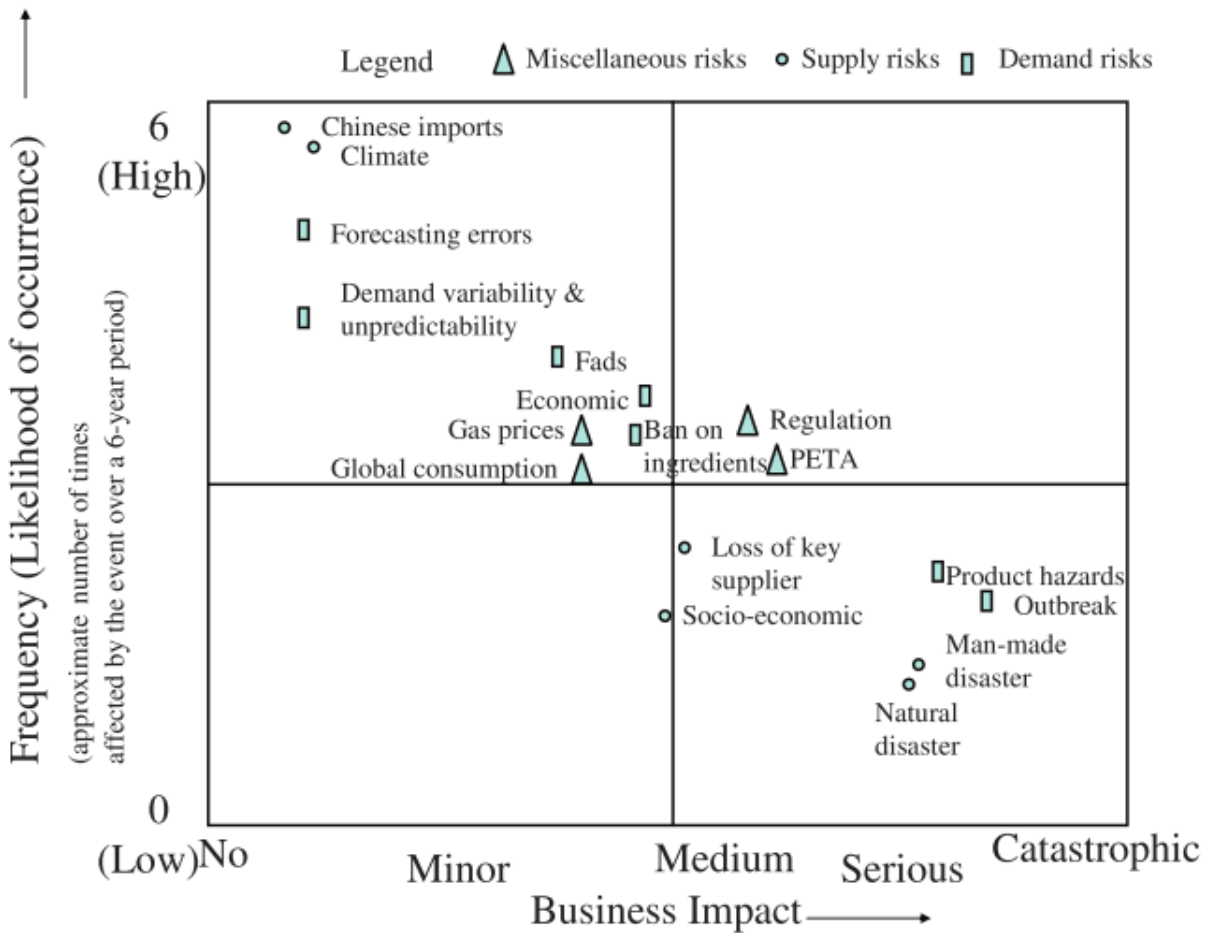


Figure 2. Supply, demand and miscellaneous risks facing a major US retail supply chain [21]

Rao and Goldsby [24] classify risk into environmental, industry and organizational (Figure 3). Regulatory risk would fall under the category of environmental risk.

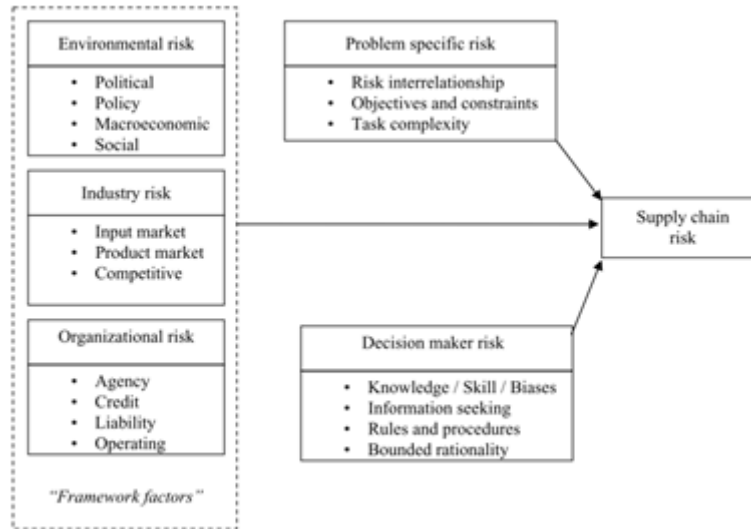


Figure 3. Sources of supply chain risk [24]

Rao and Goldsby [24] have created a typology of supply chain risk. They classify political uncertainty, policy uncertainty and macroeconomic uncertainty as environment risk drawing from the typology presented by Miller [19]. They cite more recent examples of United States Golf Association changing its golf club acceptability norms, and Mattel’s legal liabilities concerning presence of hazardous material in toys which resulted in a recall as examples of Industry risk. They highlight that hazardous material regulation, product recall requirements and product liability issues have resulted in increased logistics costs and complexity [24].

Political instability has been identified as an exogenous discrete risk [36]. A supply chain disruption as a result of regulatory issues political instability is considered to be a potential discrete risk in their questionnaire.

Regulatory risk has been classified under external risks [3]. In the same paper, they classify fuel price fluctuations and exchange rate fluctuations under economic risks, labor strikes under social risk, changes in import and export regulations and tariff changes under legal risk.

External risks are difficult to handle. Though some idea can be gained about their effects based on historical data, there can be uncertainties associated with establishing causality, likelihood and impact [37].

Different authors categorize risks differently [59]. The absence of consensus among researchers is also observed specifically as to what makes up regulatory risk.

From the review of the current classification structures and definitions of what constitutes regulatory risk/ uncertainty and disruptions, one can see that the research carried out is not well structured and focused. However, some of the common characteristics of the classification observed were:-

- Classification of risks/ uncertainties as internal or external to organization (within or outside an organization or its supply chain).

- Risks/ uncertainties associated with regulation change have been identified as unique risks/ uncertainties by a few authors ([10][24][28][30][36]) while others have described it under political, social, security and policy.
- Risks/uncertainties associated with regulation change are a subset of external or indirect or environmental risks.

Thematic coverage of literature associated with regulatory risk/uncertainty/disruption

Given the current state of debate in popular publications about the regulatory risk/uncertainty/ disruptions, it is important to review literature that covers regulatory risk/uncertainty/ disruptions based on the:-

- original theme of the research,
- research methodology adopted and
- the year of publication.

This was done to identify gaps that can be addressed in future research. The studies selected were limited based on their coverage of regulatory risk/ uncertainty/ disruption and their focus on positioning regulatory risk as a part of a larger body of risk literature.

We observe that most of the coverage that regulatory disruptions has gained is from the literature on risk management (which would include risk mitigation too). The major themes were identified based on the reading of the forty four documents that were collected and discussion between the authors. For example, Pustay [23] Taylor [34] and Harris, Parker and Cox [11] talk about deregulation and/or privatization while Banomyang[2], Williams, Ponder and Autry [41], Autry and Bobbitt [1] are a few of the articles that clearly focus on the theme of supply chain security. Appendix 4 gives the entire list and details of the literature review. The first two columns give the author and publication date details. The third highlights the type of study (methodology followed), the fourth column was the section in the article/ paper which we found relevant to our research in trying to describe what is regulatory risk/uncertainty/disruption and the fifth column gives the underlying theme of the respective article/ paper.

We observe that most of the coverage is from the literature on risk management (which would include risk mitigation too). Majority of the studies that were carried out on risk management- (thirteen of eighteen such studies happened) between 2003 and 2009. The second most popular theme was the effect of regulatory change / regulations with a majority of the articles being published between 2005 and 2015.

Empirical methodology- consisting of either primary research, secondary research or both was the most preferred. Research on the theme of effect of regulatory change/ regulations had adopted empirical, mixed method and modeling research. We found very few studies had focused on using case studies and longitudinal studies.

Table 2. Research methodology adopted by articles pertaining to regulatory uncertainty / risk/ disruptions

Theme	Case study	Empirical	Mixed Method	Modeling	Grand Total
Deregulation and/or Privatization		3			3
Effect of disruptions			1	1	2
Effect of regulatory change/ regulations	1	3	4	4	12
Risk framework development		3			3
Risk Management	1	13	3		17
Supply Chain Security		6	1		7
Grand Total	2	28	9	5	44

When we compared the theme of the studies from a temporal perspective, we observed a few patterns. Deregulation based papers were published between 1982 till 1996. Recent topics of interest include supply chain security and the effect of regulatory change / regulations. Risk management has been researched on most consistently between 2000 and 2015.

Table 3. Temporal distribution of themes of studies that touched upon regulatory uncertainty/ risk/ disruption

Theme/ Year	1982	1992	1994	1996	1998	2000	2001	2003	2004	2005	2006	2007	2008	2009	2011	2012	2014	2015
Deregulation and/or privatization	1		1		1													
Effect of disruptions										1		1						

Effect of regulatory change/ regulations				1			1				2		2		1	3	2	
Risk framework development		1		1				1										
Risk Management						1		1	3	2		1	2	3		3	1	
Supply Chain Security										1			2	1				3
Grand Total	1	1	1	2	1	1	1	2	3	4	2	2	6	4	1	6	3	3

We will now look at the specific coverage of each theme highlighted in table 2.

- Deregulation and/or privatization

Research on deregulation which was reviewed was written before the 2000’s. Deregulation has played an important role in the way businesses work. Deregulation in the United States started in the late 70’s, early 80’s. Removal of specific regulations on the industry was thought to improve competition.

An early example of regulatory risk due to regulation is that covered by Pustay [23]. His work deals with the reform of regulations regarding contract carriage in the American transportation sector and its effect on small businesses [23].

It was found that de-regulation did not always have a positive effect on the industry and the value it is supposed to deliver. For example, it was feared that the privatization in the transportation sector in Russia (especially the larger state players) would lead to formation of monopolies that would exclusively service certain regions and create logistics inefficiencies [34].

- Effect of disruption

Disruptions can affect the smooth functioning of an organization. Regulations and regulation change can hinder daily and long term operations. For example, Legal liability can arise for organizations for not acknowledging the causes of disruptions [12]. Wilson [42] talks about supply chain disruptions being caused due to political instability [42]. Labor strikes are also highlighted as causes of disruptions especially in retail marketplaces. Wilson highlights that such disruptions (including transport disruptions) can affect supply chain performance.

- Effect of regulatory change/ regulations

In the literature having this theme, sub-themes covered included effect of regulation/ regulation change, regulatory compliance mechanisms, financial and operational costs of regulation change, and the effect of regulation change on innovation.

Changing government regulations can be viewed as an intervention made by governments to “balance a range of competing and often contradictory interests” of the producer or consumer [25]. Sanderson [25] then classifies government regulations as being either creative or disruptive -based on whether it favors the buyer or the supplier respectively. An example of a creative regulation would be the removal of agricultural subsidies and opening up off the markets in the European Union, while an example of disruptive regulations would be the involvement of the government in the electricity generation supply chain in the United Kingdom to improve efficiencies in order to have them pass more value to the end customer [25].

Regulations are different from standards as they establish specifications with a compulsory character [26]. However, the adoption of standards can become mandatory under cases of government/ international acceptance as requirements.

Walker, Di Sisto and McBain [38] talk about the difficulties facing the implementation of green supply chains and highlights that innovation is sometimes affected by existence of regulations through “prescription of best available techniques and setting of unreasonable deadlines” [38]. A few authors have also tried to find out the cost of implementing regulations- specifically those related to green supply chains. Palak, Ekşioğlu and Geunes [22] and Toptal, Özlü, and Konur [35] have modeled the effects of carbon regulatory mechanisms on operational and financial costs. Environmental laws (specifically of for this case, environmental does not mean the business environment) have been established. Enforcement of these regulations will depend on the regulation, industry and the firm and primarily depends on the monitoring of processes that help the firms comply to regulations. Alternatively, there are mechanisms of voluntary agreements (public voluntary-e.g. EPA non mandatory, unilateral-e.g. industry for industry and negotiated- between public authorities and industry-e.g. EPA’s Project XL). Having regulatory enforcement ombudsman, regulatory fairness boards, participation by small businesses, environmental management systems and citizen enforcement for liability are other mechanisms used [8].

Audit reports by government companies has been mentioned as one of the tools to penalize companies for non-compliance [26].

Government policy makers also have regulatory alternatives that include mandatory take-back laws, public information campaigns and even financial incentives when it comes to remanufacturing [20].

Governments have used coercion (through legislation) and economic incentives to ensure compliance to environment based laws [29].

Governments also use regulations to “protect” industries. While tariffs have been falling with respect to imports, Non-Tariff Barriers (NTB) have increased in the recent past [39]. These can include safeguard controls, anti-dumping etc.

The major highlights from these articles were:-

- Government regulations which may aid one section of the industry may not help another.
 - Changing regulations can lead to an increased risk for operators in the business and may hurt smaller ones or are more beneficial to larger ones.
 - Effects of regulation change affecting the supply chain included (but were not limited to) legal liabilities, penalties, decreased supply chain performance, changes in the industry structure, negative effect on innovation and financial and operational costs associated with the decision to comply with the changes.
 - Mechanisms that governments use to ensure compliance include- but are not limited to monitoring, voluntary agreements, and negotiated agreements, regulatory enforcement ombudsman, regulatory fairness boards, audit reports, take back laws, public information campaigns, financial incentives and even coercion through legislation.
- Supply Chain Security

The concept of the secure supply chain was developed due to the far reaching effects of terrorist activities. Port and trade security initiatives were taken by governments all over the world which established processes between governments, traders, ports, (logistics) service providers and insurance providers. Such initiatives included the US Container Security Initiative (CSI), Customs-Trade Partnership Against Terrorism(C-TPAT) [2][16] [32]. Wide ranging regulatory changes were adopted to put this process in place. Secure supply chain culture even has measures developed to measure it [41].

Williams, Leug and LeMay (2008) have proposed that organizations look at supply chain security to be a supply chain risk management strategy. They also highlight that a focus on Supply Chain Security will help reduce the effect of socio-political actions [40].

Political and legal factors are treated as external moderators between the supply chain security orientation and supply chain outcomes [1].

Setting up of appropriate policies by governments can encourage firms to innovate in order to be safer and avoid disruptions due to security risks [44].

- Risk framework development and risk management

When we combine literature that cover the themes of risk framework development and risk mitigation, the information covered relates to the classification of uncertainties, risk and disruptions based on the effects of regulation and regulatory changes. This aspect was covered in the section “Position of regulatory risk/ uncertainty/ disruption in risk/uncertainty/disruption frameworks in current logistics and supply chain literature” discussed previously.

CONCLUSION

The major outcome from this paper is the realization that there is no single piece of extant literature that exclusively covers the topic of regulatory disruptions and risks in supply chains and even

literature on general business risks and disruptions stemming from regulatory changes is lacking. This can be observed in table 4 and the subsequent discussion of the associated literature.

Furthermore, while there are papers that highlight regulatory risks and disruptions in brief or as part of their risk and disruption typologies, there is no standard typology to the risks, uncertainty or disruptions associated with supply chains. There is individual coverage of specific topics related to regulatory risks and disruptions through case studies as well as longitudinal research, however these are very rare. Most of the research carried out is cross sectional and ‘future looking’ and there are few papers that are longitudinal. As many regulations are created from a long term perspective, cross sectional studies by themselves will not do justice to the rich information that could be gathered over an extended period of time to show the effect of changes caused due to regulations. Going forward, such studies will be extremely useful.

Longitudinal studies on regulatory risks and disruptions would not only help advance the knowledge on the topic for management research but would address the concern of practitioners who have not found enough resources to tackle the effects of challenging modern regulations on their businesses and their global implications.

This paper is based on the literature that was gathered based on keywords provided in the methodology section using the EBSCOHOST and Google Scholar. However, we believe that given access to other databases such as ProQuest, a more robust set of findings may have been available.

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APPENDIX

Appendix 1: List of journals queried for

1. Academy of Management Journal
2. Academy of Management Review
3. Administrative Science Quarterly
4. Decision Sciences
5. IEEE Transactions on Engineering Management
6. International Journal of Logistics Management
7. International Journal of Operations & Production Management
8. International Journal of Physical Distribution & Logistics Management

9. International Journal of Production Economics
10. International Journal of Production Research
11. International Journal of Purchasing and Materials Management
12. International Journal of Quality and Reliability Management
13. International Journal of Quality Science
14. Journal of Business Logistics
15. Journal of Marketing
16. Journal of Marketing Research
17. Journal of Operations Management
18. Journal of Purchasing & Supply Management
19. Journal of Supply Chain Management
20. Management Science
21. Manufacturing and Service Operations Management
22. Marketing Science
23. Operations Management Research
24. Production and Operations Management
25. Strategic Management Journal
26. Supply Chain Management: An International Journal
27. Total Quality Management
28. Transportation Journal
29. Transportation Research

Appendix 2: Search operators for the search on EBSCOhost database services

Regulat* OR Law* OR Govern* OR Reform* OR Bill OR Act (searched in Abstract and Title)

OR

Enterprise* OR Compan* OR Business* OR Organisation* OR Organization* OR Entity OR Entities OR "Supply Chain" OR "Supply Chains" OR Firm* OR Econom* OR Market* OR Procure* OR Purchas* OR Suppl* OR Sourc* OR Logistic* OR Operation* OR Warehous* OR Manufactur* OR Inventor* OR Stock* OR Stor* (searched in Title)

OR

Procure* OR Purchas* OR Suppl* OR Sourc* OR Logistic* OR Operation* OR Warehous* OR Manufactur* OR Inventor* OR Stock* OR Stor* (searched in Abstract)

OR

Enterprise* OR Compan* OR Business* OR Organisation* OR Organization* OR Entity OR Entities OR "Supply Chain" OR "Supply Chains" OR Firm* (searched in Abstract)

OR

Disrupt* OR Risk* OR Uncertain* OR Unpredict* OR Threat* OR Impact* OR Loss* OR Suffer* OR Profit* OR Declin* OR Decreas* OR Dwindl* OR Reduc* OR Lose OR Losing OR Down* (searched in Abstract)

Appendix 3: List of initial articles

- Autry, C. W., & Griffis, S. E. (2008). Supply chain capital: The impact of structural and relational linkages on firm execution and innovation. *Journal of Business Logistics*, 29(1), 157+. <http://doi.org/10.1002/j.2158-1592.2008.tb00073.x>
- Chang, H.-L., & Wu, J.-G. (2015). Exploring company ability to meet supply chain security validation criteria. *International Journal of Physical Distribution & Logistics Management*, 45(7), 691–710.
- Colicchia, C., & Strozzi, F. (2012). Supply chain risk management: a new methodology for a systematic literature review. *Supply Chain Management: An International Journal*, 17(4), 403–418. <http://doi.org/10.1108/13598541211246558>
- Lam, J. S. L., & Dai, J. (2015). Developing supply chain security design of logistics service providers: An analytical network process-quality function deployment approach. *International Journal of Physical Distribution & Logistics Management*, 45(7), 674–690.
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Appendix 4 (arranged by theme)

Author	Year	Type of Study (All had literature reviews)	Literature relevant to regulatory disruptions	Theme
Pustay	1982	Empirical	Effect of contract carriage regulations post de-regulation in the United States	Deregulation and/or Privatization
Taylor	1994	Empirical	Food shortage as an effect of privatization of common carrier trucking organizations	Deregulation and/or Privatization
Harris, Parker and Cox	1998	Empirical	Effect of deregulation on procurement	Deregulation and/or Privatization
Hendricks and Singhal	2005	Mixed Method	Legal liabilities associated with non-acknowledgement of disruptions	Effect of disruptions
Wilson	2007	Modeling	Cause of disruption	Effect of disruptions
Sanderson	2001	Case study	Creative and disruptive government regulations and their effects on buyers and suppliers	Effect of regulatory change/ regulations
Sangre, Gauthier and Abdul-Nour	2012	Empirical	Differentiates between regulations and standards	Effect of regulatory change/ regulations
Dixon, Gates, Kapur et al.	2006	Empirical	Mechanisms used to enact regulations that lead to compliance	Effect of regulatory change/ regulations
Walker, Di Sisto and McBain	2008	Empirical	Effect of regulations on innovation	Effect of regulatory change/ regulations
Scheraga and Calfee	1996	Mixed Method	Historical effects of information regulation on cigarette market	Effect of regulatory change/ regulations
Mitra and Webster	2008	Mixed Method	Compliance mechanisms employed by governments	Effect of regulatory change/ regulations
Sheu and Chen	2012	Mixed Method	Government strategies for compliance	Effect of regulatory

				change/ regulations
Scmhidt and Raman	2012	Mixed Method	Classification of external disruptions	Effect of regulatory change/ regulations
Scheraga	2006	Modeling	Effect of governmental restructuring on airline industry	Effect of regulatory change/ regulations
Palak, Ekşioğlu and Geunes	2014	Modeling	Operational and financial costs of carbon regulatory mechanisms	Effect of regulatory change/ regulations
Toptal, Özlü, and Konur	2014	Modeling	Operational and financial costs of carbon regulatory mechanisms	Effect of regulatory change/ regulations
Wang, Gillian and Tomlin	2011	Modeling	Import regulations with regards to non-tariff barriers	Effect of regulatory change/ regulations
Miller	1992	Empirical	Development of integrated risk framework for businesses-classification of environment risks	Risk framework development
Smallman	1996	Empirical	Perception of risk- regulatory and political risks are indirect risks	Risk framework development
Harland, Brenchley and Walker	2003	Empirical	Definition of regulatory risk	Risk framework development
Zsidisin	2003	Case study	Supply risk characteristics	Risk Management
Cagliano, DeMarco, Grimaldi and Rafele	2012	Empirical	Types of external risks	Risk Management
Manuj and Mentzer	2008	Empirical	Risk typology	Risk Management
Rao and Goldsby	2009	Empirical	Risk typology	Risk Management
Vilko, Ritala and Edelmann	2014	Empirical	Nature of external risks	Risk Management
Colicchia and Strozzi [5]	2012	Empirical	Development of supply chain risk management	Risk Management

Trkman and McCormak	2009	Mixed Method	Risk typology	Risk Management
Sodhi, Son and Tang	2012	Empirical	Classification of risks	Risk Management
Zsidisin, Panelli and Upton	2000	Empirical	Classification of risk	Risk Management
Cousins, Lamming and Bowen	2004	Empirical	Organizations perception towards compliance with regulations	Risk Management
Finch	2004	Empirical	Intellectual Property Regulations and non-compliance	Risk Management
Spekman and Davis	2004	Empirical	Risks associated with security	Risk Management
Jüttner	2005	Empirical	Classification of political and social risk as a part of environment risk	Risk Management
Kleindorfer and Saad	2005	Empirical	Risk and safety regulations trigger strategies that lead to compliance by industry	Risk Management
Oke and Gopalakrishnan	2009	Empirical	Regulations resulting in increased risk	Risk Management
Craighead, Blackhurst, Rungtusanatham and Handfield	2007	Mixed Method	Policies can bolster presence of factors that can increase the severity of a supply chain disruption	Risk Management
Tang and Tomlin	2008	Mixed Method	Risk typology, examples	Risk Management
Banomyong	2005	Empirical	Regulations associated with security risk	Supply Chain Security
Williams, Ponder and Autry	2009	Empirical	Government focus on developing supply chain security culture	Supply Chain Security
Williams, Leug and Lemay	2008	Empirical	Supply Chain Security as organizational strategy	Supply Chain Security
Autry and Bobbitt	2008	Empirical	Political and Legal factors are external moderators affecting supply chain security orientation	Supply Chain Security
Chang and Wu	2015	Empirical	Effect of Authorized Economic Operator (AEO) initiative	Supply Chain Security
Zailani, Subaramaniam, Iranmanesh and Shaharudin,	2015	Empirical	Better government policies to enhance security	Supply Chain Security
Lam and Dai	2015	Mixed Method	Security standard certifications for Logistics Service Providers	Supply Chain Security

Benefits of Adaptive Capability on the Performance of US Long-term Healthcare Providers

Dr. Christie Hui-chuan Chen, University of Tennessee at Martin

Medicaid programs experienced funding shortfalls for nursing facility care by \$6.3 billion in 2011. Such financial challenges have forced the U.S. long-term healthcare industry to search for strategies to improve operational efficiency while facing ever-increasing expenses. Over the past two decades, research on SNFs has focused on quality performance (Davis, 1991; Lenard & Shimshak, 2009) and reduced deficiencies (Castle & Ferguson, 2010). Limited research has examined U.S. long-term care facilities with regard to capability dimensions, and operational performance of SNFs. Due to heavy dependence on external funding sources such as Medicare and Medicaid, SNF providers tend to apply various strategies to pursue available opportunities via adaptive processes, such as collecting, monitoring, predicting, and adapting competitors' actions (Cohen & Levinthal, 1990; Lenox & King, 2004). Adaptive capability involves a firm's strategic flexibility to adapt, align and shift its available resources through continual changes in products and services to respond to external opportunities. Outcomes in healthcare can be measured from clinical results; patient/resident satisfaction (Meyer, 1998); and patient knowledge, attitudes and behaviors (Donabedian, 1982). Some empirical studies (Bourgeois, 1980; Wang & Wang, 2008) have implemented a combination of adaptive capabilities and operationalized adaptive capability (i.e., the ability to predict and adapt to the changing market demand and competitors' actions) to determine that firms with high adaptive capability will achieve higher performance. When firms operate with high adaptive capability in more turbulent environments, greater market growth is achieved compared to firms with lower adaptability. We maintain that a healthcare provider's ability to predict and adapt to changing market demand and competitors' actions will affect its performance.

Retirement Analysis for Millennials – A Simulation Approach

Ajay K. Aggarwal, Henderson State University, aggarwa@hsu.edu, 870-230-5300

Frank S. Smith, Colorado State University, Frank.Smith@business.colostate.edu, 501-733-6838

ABSTRACT

This study considers the net worth of the millennial generation as they approach the retirement age of 65. Previous approaches have based their retirement predictions on estimated growth rates of influencing factors. The authors utilize government statistics on influencing factors and process them through a Monte Carlo simulation, from age 18 until 65 to examine the retirement prospects of millennials. The paper also examines the retirement nest egg of millennials by ethnicity and compares them with the baby boom generation.

The paper considers variables suggested in previous studies such as life expectancy, education, income, savings rates and investment returns. New variables added to the study include race, gender, inheritance, and levels of debt. The authors use data collected from large government information sources over several decades. Data distributions were derived, where possible, and fed into a Monte Carlo simulations to draw out inferences.

BIDDING STRATEGIES IN PROCUREMENT AUCTIONS WITH INFORMATION ASYMMETRIES

Joan M. Donohue, Department of Management Science, University of South Carolina,
Columbia, SC 29208, (803) 777-5924, donohue@moore.sc.edu

Kathleen M. Whitcomb, Department of Management Science, University of South Carolina,
Columbia, SC 29208, (803) 777-2947, whitcomb@moore.sc.edu

Timothy D. Fry, Department of Management Science, University of South Carolina,
Columbia, SC 29208, (803) 777-2785, timfry@moore.sc.edu

ABSTRACT

This study explores the bidding strategies adopted by bidders in procurement auctions when the quality of information possessed by the bidders is asymmetric. In a laboratory experiment, two bidders compete against each other to procure a construction contract in which the low bidder wins. Both bidders are provided with estimates of the cost to complete the project. These cost estimates have been prepared by their own companies and therefore are different for each bidder. Bidders add in a profit margin before submitting their sealed bids. In this experiment, one bidder in each pair is “advantaged” and the other bidder is “disadvantaged.” The advantaged bidder has one or more of the following advantages:

1. data is provided on the accuracy of their own company’s past performance in similar auctions,
2. data is provided on the accuracy of the competitor’s past performance in similar auctions,
3. the cost estimate prepared by their own company is more precise than that of the competitor.

Our data is collected from college students participating in experimental sessions conducted in a university’s behavioral laboratory. The econometric software package Z-tree is used to collect data for this interactive bidding experiment. There are 12 pairs of bidders in each of nine sessions (treatment scenarios), each lasting about 1.5 hours. Each session consists of 25 rounds of bids, with the first five being practice rounds. Students are randomly selected to be an “advantaged” or “disadvantaged” bidder. In each round, and for each pair of bidders, the true cost of a construction project (unknown to the bidders) is randomly selected from actual South Carolina Department of Transportation (SCDOT) projects. Each bidder is provided with their company’s estimated cost of completing the project. The lowest bidder wins the auction and completes the SCDOT project.

We hypothesize that the advantaged bidder will win more auctions, have higher profit margins, and will be less likely to suffer the “winner’s curse,” which arises when a competitor wins the auction but incurs a negative profit because the bid amount is less than the cost of completing the project. In addition, we investigate other hypotheses based on previous findings in the academic bidding literature.

DO SERVICE LEVEL AGREEMENTS MATTER FOR CLOUD COMPUTING ADOPTION? A TRANSACTION COST MODEL

Howard G. Hamilton, College of Technology, ECPI University, 1001 Omni Blvd., Newport News, VA 23606, hhamilton@ecpi.edu, 954-515-6011

James L. Parrish (Jr.), College of Engineering and Computing, Nova Southeastern University, 3301 College Ave., Fort Lauderdale, FL 33314, jlparrish@nova.edu, 954-262-2043

Yair Levy, College of Engineering and Computing, Nova Southeastern University, 3301 College Ave., Fort Lauderdale, FL 33314, levyy@nova.edu, 954-262-2006

Marlon Clarke, College of Engineering and Computing, Nova Southeastern University, 3301 College Ave., Fort Lauderdale, FL 33314, mrclarke@nova.edu, 954-448-0334

ABSTRACT

This research was based on the transaction cost economics theory with focus on uncertainty, asset specificity and transaction cost. Service level agreement (SLA) uncertainty and SLA asset specificity were introduced by this research and used to determine the technical and non-technical attributes for cloud computing SLAs. We found that business users of cloud computing have some uncertainties about SLAs, however, these uncertainties do not seem to have significant impact on the decision to use cloud computing services. On the other hand, we confirmed that business users would prefer to have the attributes of the SLA more highly specified in the agreement. There seemed to be a high correlation between the specificity of the SLA and the adoption of cloud computing services. The research also showed that there are still concerns and uncertainties in the business domain about the general security of the cloud. Finally, this research highlighted the SLA attributes that could impact wide scale adoption of cloud computing services by business users.

INTRODUCTION

In the current environment where technology is re-constructing how products and services are delivered, many business interface with cloud computing in one way or another [1]. Cloud computing refers to both “the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services” [2, p. 50]. The cloud computing “SLA is a binding agreement between the service provider and the service customer, used to specify the level of service to be delivered as well as how measuring, reporting and violation handling should be done” [3, p. 2]. Cloud computing cannot exist without the SLA and it plays an integral role both in defining the concept and actual application of cloud computing [4] [5].

Executives and strategists continue to assess the advancement of cloud computing to determine how they can use the clouds to remain viable and to gain competitive advantage. In many instances, small and medium sized businesses are not able to acquire the technology required to be compliant in the line of business they operate. This is also true for many large operations.

The cloud provides the infrastructure and platform required to provision service for many applications in a matter of hours and worse case in days. Furthermore, the forecast showed that the cloud would re-engineer traditional computing in business enterprises [6]. However, full cloud computing adoption by corporate entities still seemed to be at a relatively slow pace [7].

Many businesses still do not understand the cloud computing concept. Therefore, they are not likely to benefit from a paradigm shift [8] induced by cloud computing. However, some argued that things have progressed and more businesses have begun accepting and using cloud computing services [1], but still not to the satisfaction of others [7] who argued that adoption is mainly by businesses with significant technology capacity. Increased cloud usage may be due to the cloud becoming more mature overtime. So, the cloud is becoming more stable and businesses are now able to develop more meaningful relationships with cloud service providers (CSPs). The cloud computing service level agreements (SLAs) are necessary tools for these relationships.

This paper is organized as follows. The problem is first described. A brief review of previous and current work on cloud computing concept and cloud computing SLAs are presented. The methodology used in this study is outlined, the conceptual framework is illustrated, our findings are discussed, and then we presented concluding remarks with implications and recommendations for future work.

THE PROBLEM

The specification of useful SLAs for cloud computing services has been a major challenge for cloud computing and its adoption [14] [19] [21] [25] [26] [28] [29] [30] [32]. Cloud computing SLAs have become more complex, challenging, and difficult for regular business users to understand [29]. While according to [26], cloud SLAs are fraught with issues which make them meaningless and ineffective. There are business users who expressed that they have never seen a supportive cloud computing SLA [27, 28]. Some claimed that cloud computing SLAs are not fitting for current requirements [19]. The challenge, according to [21], is the development of cloud computing SLAs that will ensure that the business experiences the highest quality of service. Furthermore, standard and benchmarked SLAs for cloud computing are still non-existent [25]. The issues with SLAs in multiple domain environments such as cloud computing are still not resolved [14]. Current cloud computing SLAs do not meet business requirements and are usually non-negotiable, which leaves a gap in the SLAs that, makes them undesirable [32]. The rate of business adoption of cloud computing services is severely lower than expected [30]. This is due mainly to the absence of clearly formulated SLAs and that several other attributes could be included in cloud computing agreements [30].

The calls for meaningful SLAs have been extensively documented. Effective SLAs are required before companies will have high levels of trust in the cloud [20]. While [26] advised that the dynamic nature of the cloud warrants the establishment of SLAs that contain sufficient details for cloud service engagements. [19] Argued that a comprehensive SLA is required to resolve the challenges relating to dependability, reliability and data security in the cloud. [21] Also suggested that SLAs be prepared with sufficient detail to meet the expectations of the user and should be easily assessed to enforce breaches. [29] Emphasized that the SLA is an essential aspect of the cloud computing service and companies have been advocating for more complete

SLAs. Although there are several theories relating to contractual exchanges, transaction cost economics [33] [34] [35] [36] [37] seem very relevant to this problem. Unfortunately, very little attention has been given in literature relating transaction cost economics with cloud computing SLAs and how it may help to develop more meaningful SLAs for cloud computing services.

Prior studies on cloud computing have given much more attention to general data security, SLA management, and SLA negotiation activities. [13] and [38] in their studies on cloud computing SLAs focused on the management of the SLA instead of specific attributes that would encourage adoption. [12] and [14] focused their attention on developing the requirements for a formal SLA language that would automate the definition, negotiation, and monitoring of SLAs. Again, the identification and specification of key attributes of cloud computing SLAs were not covered by their research.

PREVIOUS AND CURRENT WORK

Many studies have been conducted with emphasis on cloud computing and cloud related SLAs [9] [10] [11] [12] [13] [14]. These, however, were directed more on the security concerns and management of the SLA. While there are many business benefits of cloud computing, SLAs are becoming more important as businesses adopt cloud computing on a wide scale [15]. Several businesses are not willing to make the transition to the cloud because of the perceived lack of trust in the cloud [16].

The dynamic nature of the cloud will require special considerations when specifying and managing SLAs [13] [17] [18] [19]. Changing user requirements, resource conditions, and environmental elements are some of the attributes that should differentiate cloud computing SLAs [19]. This should be done with reference parameters such as dependability, performance, and information security [19]. The SLA forms part of the service contract and is a means of guarding against poor performance, unavailability of service, and loss of data [19] [20] [21]. Some of the concerns highlighted by prior research included data security, reliability, definition of SLAs, cloud lock-in, cost of communication, regulatory audit requirements, software licensing, portability, interoperability, and access control [2] [21] [22] [23] [24]. Therefore, the SLA has always been a concern in the discussions on cloud computing. The National Institute of Standards and Technology (NIST) [23] has made this a high priority and has been having frequent cloud metrics group meetings to define attributes and key performance indicators (KPIs) for cloud computing SLAs. Improving the cloud computing SLAs could bring many benefits to the cloud computing landscape and adoption by business enterprises.

METHODOLOGY

This study applied a mixed methods sequential exploratory research design to determine SLA attributes that influence the adoption of cloud computing. The research was conducted using two phases. First, interviews with 10 cloud computing experts, in a qualitative study, were done to identify and confirm key SLA attributes. These experts were drawn from major CSPs who offer cloud computing services globally but in particular within the United States of America, Canada and the Caribbean. In the second phase, the output from phase one was used as the input to the development of an instrument which was administered to 97 businesses, in a quantitative study,

to determine their perspectives on the cloud computing SLA attributes identified in the first phase. The business users targeted in this second phase were those in the United States of America, Canada and the Caribbean. Table 1 show the demographic characteristics of the business users who participated in this research.

This study did not isolate the various cloud computing models such as software as a service (SaaS), platform as a service (PaaS) or infrastructure as a service (IaaS). Instead the study pulled SLA attributes from all of these models so that a good mix of all types of business users could be targeted. Future research is however expected to separate the models and focus on each to determine whether similar or conflicting results would be obtained.

Partial least squares structural equation modeling was used to test for statistical significance of the hypotheses and to validate the theoretical basis of this study. Qualitative and quantitative analyses of the data were done to establish a set of attributes considered SLA imperatives for cloud computing adoption.

Table 1. Relevant demographic and cloud computing use data from respondents (N = 97)

Demographics		Frequency	Percentage (%)
Industry	Information Technology	25	25.5
	Telecommunications	1	1.0
	Education	11	11.3
	Government	29	29.9
	Services – Logistics and Dist.	3	3.1
	Finance	7	7.2
	Manufacturing	4	4.1
	Transportation	1	1.0
	Other	16	16.5
Company size	1-99	36	37.1
	100-299	16	16.5
	300-499	9	9.3
	500-699	10	10.3
	700+	26	26.8
Cloud services used	SaaS	51	52.6
	PaaS	47	48.5
	IaaS	36	37.1
	None	12	12.4
Reason for use	Agility	50	51.5
	Competitive advantage	29	29.9
	Cost savings	58	59.8
	Data/information sharing	50	51.5
	Performance over in-house	33	34.0
	None of the above	3	3.1
	Other	15	15.5

The frequency table shows that the majority (55.4%) of the responses were received from information technology companies (25.5%) and government organizations (29.9%). This was followed by other (16.5%), education (11.3%) and the finance industry (7.2%). The other industries that responded were comprised of those shown in Table 12 below. Other businesses that responded include consultancy, energy, healthcare, hospitality, housing, legal services, media and entertainment, real estate, security, and social enterprises.

SLA ATTRIBUTES STUDIED IN THIS RESEARCH

This research was done by focusing on the information security attributes of the cloud computing SLAs. The 14 attributes that identified, agreed by the 10 cloud computing experts (CSPs), and used in this research are briefly reviewed in the following sections.

Availability

Service providers seem to place significant importance on availability and guarantee an overall availability of approximately 99.9% (Google Apps Service Level Agreement; Vaquero et al., 2008). Availability from a security perspective addresses the reliability, usability, response time, and stability of the service [21]. Specific indicators for service availability could, therefore, include percentage uptime or downtime, proportion of the time the user is able to use the service, amount of time spent waiting for response (waiting time), and the number of request dealt with in a specific time (request throughput). Several CSPs (Amazon EC2; GoGrid; HP; OpSource) used uptime or downtime to define their SLA availability attribute. Since cloud computing is concerned with providing an environment for business users to access datacenter resources over the internet [4], besides uptime and downtime, the usability of the resources and the consistency with which the service is available (reliability and dependability), coupled with the speed at which the CSPs respond to requests from the customer are critical indicators of performance and service quality.

Data Integrity

The integrity of data is one of the many factors that could influence the adoption of cloud computing [44]. Secure logging of activities and encryption would also help to protect the integrity and confidentiality of data [44]. Data integrity was also highlighted as one of the important factors to understand in the cloud computing SLA trust model between cloud computer providers and users [16].

Confidentiality

Another factor that could influence the adoption of cloud computing is confidentiality [44]. Encryption of data may be done before storage in the cloud in order to aid in maintaining confidentiality and privacy of the data [44]. In addition, [44] argued that by not allowing the CSP staff to access the customers data, would help to maintain the integrity, privacy and confidentiality of the data. These are some of the bigger information concerns for business users

and induce the greatest risks especially for businesses that are constraint by compliance regulations such as those in healthcare and finance industries.

Support Response Rate

Commercial enterprises require efficient support which is guaranteed by the cloud computing SLA [26]. GoGrid included support response rate as one of its SLA attribute [46]. According to GoGrid, support response is categorized into two main classes, emergency cases and non-emergency cases. Emergency support has a 30 minutes response rate and for other cases 120 minutes is the promised service level. GoGrid said they will respond to server down, pocket losses, and routing issues as emergency cases within 30 minutes and all other cases within 120 minutes. Opsource also included support response time in their cloud computing SLA and has the same specifications for emergency and non-emergency support response time [45].

Compensation for Breaches

Durkee (2010) and all of the SLA documents reviewed addressed compensation for breaches of terms in the cloud computing SLA. Most CSPs specify the level of compensation that would be given in the event that the service provider did not meet the SLA specified.

Definition

CSPs defined the key SLA terms that will be in the SLA document. These definitions could help in understanding what the SLA entails and reduce or eliminate uncertainties in some respects. Clearly defining the SLA attributes will enhance the trust and improve the relationship between the CSP and CSU [9].

Exclusions/limitations

This helps to define the scope of the SLA. The SLA documents that have been reviewed as part of the content review included exclusions or limitations to define the boundaries of the SLA. For example, GoGrid indicated in its cloud computing SLA that network performance due to the users' connection to the internet has been excluded from the agreement [46]. Exclusions or limitations seem to be included in most of the SLA documents reviewed.

Network performance

Generally, according to [9], the cloud computing SLA helps to monitor the users' experience of the performance of the cloud. GoGrid [46] also included network performance of the cloud as an attribute in their cloud computing SLA and promised high levels of availability for internal network performance. However, they added that the network performance of the users' local network is an exclusion of the cloud computing SLA.

Cloud storage

Several CSPs (GoGrid; HP; IBM; Rackspace) also provide what is called persistent, block or object storage services to CSUs. These services allow users to store various forms of contents in the cloud and access them on demand.

Maintenance/emergency

GoGrid stated that downtime due to schedule emergency maintenance will not be considered failure in their cloud computing SLA [46]. They defined emergency maintenance as activities required to resolve hardware or software problems and other issues associated with attacks by viruses or worms [46]. GoGrid also expressed that they will make every effort to inform customers of emergency maintenance, however, this notification is not a guarantee [46].

Physical security

The general security of cloud computing is a major concern [21]. GoGrid has also included a physical security attribute in their cloud computing SLA [46]. They claimed that they have 24 x 365 on-site physical security. Physical security includes controls that are implemented to safeguard the physical environments of the cloud computing facilities. These controls must also be assessed through frequent audits to help build the trust and confidence between the CSP and the CSU.

Physical location

The physical location of clouds has also been highlighted as a concern and is, therefore, being included for review and inclusion as an SLA attribute [16]. The need, therefore, exists for this research to look at whether details about physical location of clouds need to be included in the SLA.

Engineering support

Engineering support refer to support offered by the CSP to monitor the cloud network resources and provide support to the CSUs (GoGrid). According to GoGrid 24x365 engineering support is provided and included in their cloud computing SLA.

Service Organization Control Audits and Reports

According to [44], open and transparent security practices in the cloud should be mandated. This can be assessed through frequent and periodic audits of the CSPs cloud computing infrastructure and services. Service Organizations Control (SOC) reports are becoming very applicable to providers of services such as cloud computing [47]. These audits should produce reports such as the Statement on Auditing Standards Number 70 (SAS 70) or the Statement on Standards for Attestation Engagements Number 16 (SSAE 16). These reports may then be shared with business users (or potential business users) through the cloud computing SLA.

The introduction of internal controls that are of international standards, such as the SSAE 16, could build needed confidence of business users in cloud computing SLAs and ultimately cloud computing services. Security certification such as International Standards organization (ISO) 27000 would be useful to help build the trust through improved integrity and confidentiality [44]. According to [47], the SAS 70 and SSAE 16 are audit frameworks that provide assurance of controls in service organizations. The SAS 70 has been replaced by the newer SSAE 16 audits [47]. The SSAE 16 requires that a description of the system and appropriateness of the design together with the effectiveness of the controls be presented in the report [47]. The management of the service organizations, under the SSAE 16, is expected to provide a written report of the fairness of the audit results which provides an attestation of the outcome of the audit and the report [47].

CONCEPTUAL FRAMEWORK

Figure 1 illustrates the concept model that was used in this research. The model is based on the transaction cost economics theory [33, 34, 35, 36, 37]. It introduces four main factors that were used to study cloud computing SLAs: 1) SLA uncertainty which is comprised of technical uncertainty and non-technical uncertainty; 2) SLA asset specificity which includes technical asset specificity and non-technical asset specificity; 3) transaction costs which are the administration costs involved in activities relating to cloud computing engagements; and 4) intention to adopt which refers to the behavior of potential business users towards adopting cloud computing services based on a specific SLA.

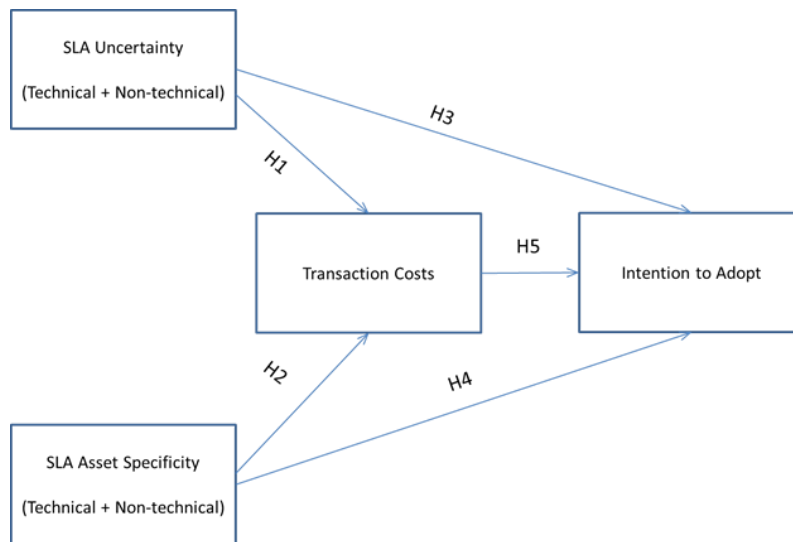


Figure 1. Conceptual model for cloud computing SLAs

Uncertainty and asset specificity have been identified as two main constructs of transaction cost economics [36]. Accordingly, uncertainty defines the level of uncertainty associated with commercial transactions. All complex contracts are incomplete and are subject to uncertainties and opportunistic behaviors [36]. Uncertainty is responsible for many of the difficulties and

failures in economic and commercial transactions [31]. Cloud SLA uncertainty represents the degree of uncertainty that exists in cloud-based service agreements and transactions.

Asset specificity is the extent to which investments in particular transactions are specialized [34]. Special purpose technology is an example of an item with high asset specificity while general purpose technology is the reverse [31]. Contractual complexities will arise with high asset specificity and the need to adjust to uncertainties [31]. Highly specialized items are associated with more problems and complications [34]. Therefore, it is in the best interest of the provider and the client to design agreements that encourage mutual benefits and continuity. For the purposes of this research, cloud computing SLA asset specificity is the degree to which the relevant components of the cloud SLA is required to be fully specified in the agreement. The following alternate hypotheses were used to test the significance of attributes and factors highlighted in Figure 1 to the intention to adopt cloud computing.

- H1** High SLA uncertainty will negatively impact transaction costs.
- H2** High SLA asset specificity will negatively impact transaction costs.
- H3** High SLA uncertainty will negatively impact the intention to adopt cloud computing.
- H4** High SLA asset specificity will positively impact the intention to adopt cloud computing.
- H5** High transaction costs will negatively impact the intention to adopt cloud computing.

Partial least squares (PLS) were used to test statistical significance of the hypotheses and determine the model-data fit. PLS was also used to evaluate the validity of the theoretical framework and concept model.

RESULTS AND FINDINGS

The SmartPLS results are shown in the model in Figure 2.

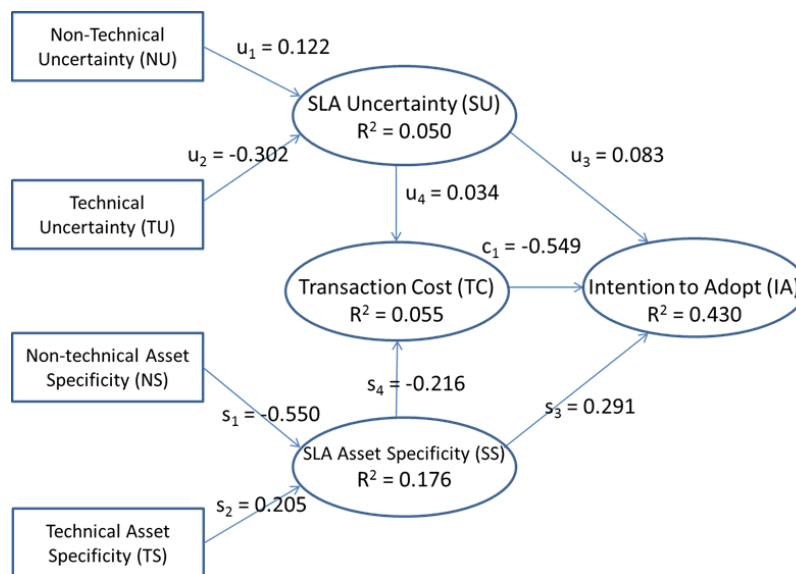


Figure 2. Path coefficients and R² values for inner model latent variables

By examining the model depicted in Figure 2, it can be seen that the coefficient of determination, R^2 , is 0.430 for the IA endogenous latent variable. This means that the three latent variables (SU, SS, and TC) moderately explained 43.0% of the variance in IA. SU and SS together explained 5.5% of the variance in TC. By observing the model it can also be seen that only 5.0% of the variance in SU is explained by NU and TU, while a low of 17.6% of the variance in SS is explained by NS and TS combined.

The inner model suggests that TC has the strongest effect on IA (-0.549) followed by SS (0.291) and SU (0.082). The direction of the effect of TC on IA showing - 0.549 is an inverse effect which implies that higher TC could result in lower rate of IA. This, therefore, suggests that the hypothesized path relationship between TC and IA (H5) is statistically significant. The hypothesized path relationship between SS and IA (H4) is also statistically significant with the standardized path coefficient of SS (0.291) greater than 0.2 [39]. This implies that the path relationship between SU and IA (H3) is not statistically significant. It also indicates that SS has a stronger effect on TC (-0.216), than SU (0.034) on TC. Based on the magnitude of the path coefficient for the SS and TC link (-0.216), this path (H2) is also statistically significant. However, the path linking SU and TC (0.034) (H1) is not statistically significant (path coefficient $0.034 < 0.2$). The model further suggests that TU (-0.302) has a stronger effect on SU than NU (0.122) and NS (-0.550) has a stronger effect on SS than TS (0.205).

Table 2. Correlation values among latent variables

	IA	NS	NU	SS	SU	TC	TS	TU
IA	1.000							
NS	-0.453	1.000						
NU	-0.036	-0.060	1.000					
SS	0.377	-0.396	0.085	1.000				
SU	0.149	0.274	-0.109	-0.519	1.000			
TC	-0.605	0.297	0.145	-0.233	0.146	1.000		
TS	-0.422	0.748	-0.050	-0.206	0.186	-0.359	1.000	
TU	0.063	-0.049	0.764	0.137	-0.209	0.029	-0.054	1.000

The Bootstrapping algorithm in SmartPLS was used to compute t-statistics for significance testing of the inner and outer model of the structural paths. According to [39], the bootstrapping procedure in SmartPLS estimates the normality of the data during execution. The one-tailed t-test with a significance level of 5% was used to compute the t-statistics for the structural paths. For significance level of 5%, the path coefficient will be statistically significant if the t-statistic is larger than 1.96. If the significance level is 10%, then the path coefficient will be significant for t-statistics greater than 1.65. Table 3 shows the t-statistics for the structural paths in the model.

Table 3. T-Statistics of inner model path coefficients

Path	T-Statistics
NU → SU	1.115
TU → SU	2.418**
NS → SS	3.244***
TS → SS	1.902*
SU → TC	0.455
SS → TC	1.679*
SU → IA	1.295
SS → IA	3.226***
TC → IA	7.944*****

*p-value < 0.1; **p-value < 0.05; ***p-value < 0.01; *****p-value < 0.001

The results in Table 3 show that the TU → SU (2.418), NS → SS (3.244), TS → SS (1.902), SS → TC (1.679), SS → IA (3.226), and TC → IA (7.944) paths are statistically significant. This suggests that the hypothesized paths SS → IA (3.226) (H4) and TC → IA (7.944) (H5) are statistically significant at least at the 0.05 significance level, while SS → TC (1.679) (H2) is significant at the 0.1 level. The hypothesized paths SU → TC (0.455) (H1) and SU → IA (1.295) (H3) are not statistically significant neither at the 90% confidence level (t-value > 1.645 and p-value < 0.1) nor 95% confidence level (t-value > 1.96 and p-value < 0.05). Table 4 shows the results of the hypothesis testing.

Table 4. Results of hypothesis testing

Hypotheses	Results
H1: High SLA uncertainty will negatively impact transaction cost	Not Supported
H2: High SLA asset specificity will negatively impact transaction cost	Supported
H3: High SLA uncertainty will negatively impact the intention to adopt cloud computing	Not Supported
H4: High SLA asset specificity will positively impact the intention to adopt cloud computing	Supported
H5: High transaction cost will negatively impact the intention to adopt cloud computing	Supported

Reliability and Validity

In examining the structural model, the reliability and validity of the latent variables were also determined. Indicator reliability and internal consistency reliability were examined to check the reliability of the latent variables. Convergent validity and discriminant validity were evaluated to determine validity of the latent variables. The SmartPLS software provided the details needed to determine reliability and validity in all aspects of the model. Appendix 1 gives a summary of the descriptive measures of the outer model.

Indicator Reliability

Indicator reliability is the square of the loadings for each indicator. As shown in Appendix 1, all the individual indicator reliability values (when rounded up to one decimal place) were greater than or equal to the minimum 0.4 [39]. Therefore, the data met the requirement for indicator reliability.

Internal Consistency Reliability

Cronbach's Alpha and composite reliability values from SmartPLS were used to measure the internal consistency reliability of the structural model. As shown in Appendix 1, both the alpha values and composite reliability values exceeded the 0.7 minimum. Therefore, high levels of internal consistency reliability have been confirmed among all the latent variables.

Convergent Validity

Using Appendix 1, it can be seen that the Average Variance Extracted (AVE) for each latent variable has been found to be equal to or greater than the minimum acceptable value of 0.5 [39]. This suggests that convergent validity of the latent variables were also confirmed.

Discriminant Validity

The Fornell and Larcker criterion for examining determinant validity was used by SmartPLS [43]. The square root of the AVE values for each latent variable was taken and presented in Table 5 below. According to [39], in application of the Fornell-Larcker principle, if the computed value is greater than the other correlation values among the latent variables, then discriminant validity would have been demonstrated. The correlation among the latent variables were reported by SmartPLS and shown in Table 2.

Table 5. Square Root of AVE and the Correlation Values among the Latent Variables

	IA	NS	NU	SS	SU	TC	TS	TU
IA	0.698							
NS	-0.453	0.759						
NU	-0.036	-0.060	0.752					
SS	0.377	-0.396	0.085	1.000				
SU	0.149	0.274	-0.109	-0.519	1.000			
TC	-0.605	0.297	0.145	-0.233	0.146	0.808		
TS	-0.422	0.748	-0.050	-0.206	0.186	-0.359	0.779	
TU	0.063	-0.049	0.764	0.137	-0.209	0.029	-0.054	0.754

Model Fit and Goodness of the Model

The use of communality, redundancy and goodness of fit (GoF) were suggested as global fit measures to validate the quality of a PLS structural model [41]. [42] Also recommended the use of communality and GoF. The model fit for the structure described in this study will be discussed

using [40] effect size index and [41] communality and GoF measure for PLS path modeling. Both approaches will be using the AVE and R^2 to determine effect size and model-data fit.

[40] Classified effect size as small, medium and large. He highlighted that the proportion of total variance accounted for by group membership (or R^2) may be used as one of the methods to determine the effect size. [40] used the variable 'f' to represent the effect size. A small effect size occur at a minimum of $f = 0.10$; a medium effect size at $f = 0.25$; a large effect size at $f = 0.40$ [40]. Relative to these f indices, [42] emphasized Cohen's effect size f as being equivalent to R^2 of 0.02 for small effect, 0.13 for medium effect, and 0.26 for large effect. Based on these recommendations to assess the effect size of the constructs, SLA uncertainty (SU) has small effect on the model ($R^2 = 0.050$; $0.02 < R^2 < 0.13$), SLA asset specificity (SS) has a medium effect on the model ($R^2 = 0.176$; $0.13 < R^2 < 0.26$), transaction cost (TC) has a small effect on the model ($R^2 = 0.050$; $0.02 < R^2 < 0.13$), and all of these contribute to intention to adopt (IA) with a large effect on the model ($R^2 = 0.430$; $R^2 > 0.26$). Therefore, based on the effect size determined by the R^2 values, there is a large model-data fit for the overall structural model presented by this research.

Communality and GoF were used to determine global fit for the PLS model [40, 42]. According to [42] communality is equivalent to the AVE in PLS and is assumed an average of 0.5 for good fit [43]. The structural model shown in Figure 2 exhibits an AVE of at least 0.5 for all the endogenous latent variables SU, SS, TC, and IA. Using communality and AVE, the overall structural model presented in this research demonstrated model-data fit.

In addition, [41] as well as [42] theorized that GoF is equivalent to the square root of the product of the average AVE of 0.5 proposed by [43] and the average R^2 for the model. This results in a GoF for the model of 0.626. According to [42] the effect of the GoF can be classified as small (GoF = 0.1), medium (GoF = 0.25), and large (GoF = 0.36). The GoF measure (GoF = 0.626; GoF > 0.36) for the structure presented by this research demonstrates that the PLS model is validated globally with a very large effect for the goodness of model-data fit.

The communality (AVE), R^2 fit, and the GoF value confirmed that the model performs very well in relation to the benchmarked effect size and measures proposed [40] [41] [42]. There is goodness of fit for the overall structural model presented by this research.

CONCLUSIONS

The findings suggest that SLA uncertainty has very little impact or has only little effect on transaction cost neither does it present any serious threats to the intention to adopt cloud computing (H1 & H3). This may be due to the fact that some companies just simply accept the SLA as presented to them when they are about to acquire the service. The data showed that there are little or no concerns by business users about the non-technical SLA uncertainties (NU → SU has low path coefficient = 0.122 and t-value = 1.115). However, this is not the case for the technical SLA uncertainties. The data suggested that there are concerns about the technical SLA uncertainties as TU → SU has path coefficient of -0.302 and t-value of 2.418 reflecting statistical significance at the 95% confidence level (t-value > 1.96 and p-value < 0.05). SLA asset specificity, however, seems to have some impact on transaction cost (H2) and will influence the

intention to adopt cloud computing services (H4). Transaction cost will also have an impact on the intention to adopt cloud computing (H5).

While there is no known research using transaction cost economics and PLS to conduct a similar study focusing on cloud computing, this research confirmed some of the principles surrounding transaction cost economics. [34] and [35] defined site specificity, physical asset specificity, and human asset specificity as the three types of asset specificity for transaction cost economics. Relative to cloud computing, this study demonstrated that SLA asset specificity has a significant impact on transaction cost. [34] Argued that transaction cost is less where there exists less asset specificity, suggesting that there is a relationship between transaction cost and asset specificity. [34] Also theorized that as assets become more specific the transaction cost increases as service agreements become more necessary. H2 of this study supports this argument.

[31] Found that uncertainty could give rise to increase difficulty and cost to manage contracts associated with bounded rationality. While this study found some relationship between SLA uncertainty and transaction cost (H1), the effect was small (t-value = 0.455 for SU → TC) or the correlation was very weak for the path SU → TC (0.146 or 14.6%).

This study also identified SLA attributes that are influencing cloud computing adoption. Table 5 shows the list of attributes produced by SmartPLS. There were 11 discrete attributes that seemed to influence the adoption of cloud computing services (see Table 6 below).

Table 6. Attributes of cloud computing SLAs that influence business adoption of cloud computing

SLA Attribute	Attribute Class
Business continuity planning	Non-technical
Compensation for breaches	Non-technical
Exclusion/limitation	Non-technical
Support response rate	Non-technical
Availability	Technical
Confidentiality	Technical
General security	Technical
Orchestration	Technical
Portability	Technical
Physical security	Technical
Reliability	Technical

According to the model in Figure 1, though SLA uncertainty on a whole showed only little effect on intention to adopt (SU → IA has path coefficient = 0.083 t-value = 1.295), uncertainty in business continuity and disaster recovery, exclusion, general security, and portability will influence the intention to adopt cloud computing services. Attention should, therefore, be placed on these areas of uncertainty as they could have some effect on intention to adopt cloud computing. The data also suggested that the specification of compensation for breaches, support response rate, availability, confidentiality, orchestration, physical security, and reliability will also influence how business customers adopt to cloud computing services. Overall, of the 11 attributes that have been determined by the model to have significant impact on the intention to

adopt cloud computing, only 4 of them were from SLA uncertainty and 7 were from SLA specificity (see Table 6). Also, 4 were non-technical and 7 were technical attributes. It is also worth paying attention to general security as this research suggested that this is also still a major concern in the business domain and seemed to be influencing business decision to adopt and use cloud computing services.

IMPLICATIONS AND LIMITATIONS

As cloud computing continues to develop, the issues surrounding its use could influence business adoption. Besides the highly exposed concerns about information security in the cloud, the challenges with cloud computing SLAs continue to be a major discussion among the business environment. Meaningful and relevant SLAs for cloud computing services could help foster trust and improve relationship with business consumers and providers. This could move the cloud to the next level where more businesses are confident in migrating core and critical applications to the cloud.

This study focused on SLA attributes that could help streamline and standardize the contents of cloud computing SLAs. As the effort to arrive at a methodology to standardize cloud computing SLAs continues, the results of this study could contribute to the initiatives that will be executed. This research, therefore, has substantial implications to the project currently being executed by the National Institute of Standards and Technology (NIST) to propose metrics for cloud computing services. The main limitation to the study is that there were no separation of the cloud service models such as IaaS, PaaS, and SaaS. This study looked at general SLA attributes of cloud computing agreements which could have implications in generalizing the results.

Pertaining to the knowledge base for cloud computing SLAs, this study provided a new perspective for studying the influence of cloud computing SLAs on the intention to adopt cloud computing services. The application of transaction cost economics now allows researchers to view the intention to adopt cloud computing by looking at the uncertainties that exists within the SLA, how much is specified in the SLA and overall costs surrounding the execution and use of the SLA during the life cycle of the agreement. Though uncertainties seemed to have little effect on intention to adopt cloud computing in this study, there are still at least 12 attributes that business customers seem to need clarity or have doubts about. Therefore, in the context of this study the data is showing that it is important to address this area of concern.

Overall, this study should add to the knowledge base for cloud computing and SLAs. It should aid in the development of standards for cloud computing SLAs and provide the basis for which metrics and KPIs can be developed to help monitor service agreements for cloud computing services. It is also expected that the results of this study will help to develop more meaningful cloud computing SLAs to foster greater adoption of cloud computing, in particular businesses moving more of their critical applications to the cloud.

RECOMMENDATIONS FOR FUTURE RESEARCH

There is much latitude for future research in this area. In this study, the conceptual model was validated qualitatively using an expert panel and then quantitatively using a survey methodology.

Future studies could apply the model to study cloud computing adoption in different contexts or seek to extend the initial model. In addition, further research could look at applying the covariance structural equation modeling (SEM) technique in the analysis to assess whether a similar fit would result. Further studies could also focus on developing KPIs and metrics for the attributes that have been identified in this study and obtain the perspectives of business users on these metrics in a quantitative study similar to this research. Additionally, researchers could extend this study by focusing on specific models to include IaaS, PaaS, and SaaS. This should help with the generalizability of the model and assist in taking cloud computing closer to SLA standardization.

APPENDIX 1

Descriptive Measures of the Outer Model (Outer Model Loadings)

Latent Variable	Indicators	Loadings	Indicator Reliability (Loadings ²)	Composite Reliability	Cronbach's Alpha	AVE
NU	n_com_su	0.815	0.664	0.864	0.851	0.565
	n_eng_su	0.632	0.399			
	n_fea_su	0.694	0.482			
	n_mtn_su	0.648	0.420			
	n_soc_su	0.928	0.861			
TU	t_ava_su	0.612	0.375	0.900	0.890	0.568
	t_con_su	0.809	0.654			
	t_gsec_su	0.893	0.797			
	t_int_su	0.871	0.759			
	t_orch_su	0.647	0.419			
	t_port_su	0.637	0.406			
	t_rel_su	0.754	0.569			
NS	n_bc_ss	0.787	0.619	0.843	0.756	0.575
	n_eng_ss	0.835	0.697			
	n_loc_ss	0.663	0.440			
	n_neg_ss	0.738	0.545			
TS	n_gsec_ss	0.770	0.593	0.860	0.804	0.607
	n_orch_ss	0.714	0.510			
	n_port_ss	0.840	0.706			
	n_rel_ss	0.786	0.618			
SU	uncert_u	1.000	1.000	1.00	-	1.00
SS	specify_s	1.000	1.000	1.00	-	1.00
TC	n_def_cs	0.825	0.681	0.954	0.947	0.653
	n_exc_cs	0.790	0.624			
	n_mtn_cs	0.792	0.627			
	n_neg_cs	0.795	0.632			
	n_sup_cs	0.865	0.748			
	t_con_cs	0.865	0.748			
	t_gsec_cs	0.795	0.632			
	t_int_cs	0.851	0.724			
	t_orch_cs	0.753	0.567			
	t_perf_cs	0.753	0.567			
	t_sto_cs	0.797	0.635			
	n_bc_au	0.693	0.480			
	n_com_as	0.745	0.555			
	n_exc_au	0.676	0.457			
	n_sup_as	0.794	0.630			

Latent Variable	Indicators	Loadings	Indicator Reliability (Loadings ²)	Composite Reliability	Cronbach's Alpha	AVE
IA	t_ava_as	0.691	0.477	0.912	0.984	0.487
	t_con_as	0.706	0.498			
	t_gsec_au	0.691	0.477			
	t_orch_as	0.600	0.360			
	t_port_au	0.700	0.490			
	t_psec_as	0.647	0.419			
	t_rel_as	0.718	0.516			

APPENDIX 2

Indicator Variables Used

SECTION A – Cloud Computing SLAs

SLA Uncertainty

What is your perception about each of the following as they are represented in the cloud computing SLA?

Items	Variables
1. I am not sure that the amount of availability specified in the cloud computing SLA can be achieved by the provider or I have doubts surrounding the availability of cloud computing	t_ava_su
2. I am not certain that the integrity of the data stored in the cloud is maintained by the provider and I am not sure that the SLA appropriately addresses data integrity	t_int_su
3. I do not believe or I am doubtful that cloud computing SLAs address concerns about confidentiality of information and data in the cloud.	t_con_su
4. I am not sure what the support response rate is for cloud computing services being offered by cloud service providers	n_sup_su
5. It is not clear how compensation for breaches is computed and I am unsure about what to expect	n_com_su
6. The attributes of the cloud computing SLAs are not well defined and therefore result in lack of understanding or doubts about them	n_def_su
7. I am very certain about what the limitations of the cloud computing services are and what are excluded from the services being provided	n_exc_su
8. There is no guarantees about the expected performance of the cloud service providers' network and I am therefore uncertain about what to expect in this regard	t_perf_su
9. I am uncertain about the amount of storage to receive from cloud service providers	t_sto_su
10. I am uncertain about how the cloud service providers deal with emergency maintenance and similar activities which could impact the availability of the service	n_mtn_su
11. I am unsure about the physical security of the facilities used by providers to offer cloud computing services	t_psec_su
12. There is no information given by the cloud service provider that highlights the physical location from which the cloud service is being provided thereby causing some uncertainties about the guarantees of the service	n_loc_su
13. I am not sure whether there is engineering support to users of cloud services and how much time is allotted for engineering support	n_eng_su

14. I am not sure that the cloud service provider is conducting frequent information security audits of the cloud infrastructure and making reports such as the SAS70/SSAE16 available as part of the cloud computing SLA	n_soc_su
15. I am uncertain that I can control and manage my cloud resources when this becomes necessary	t_orch_su
16. I am not sure that the cloud service provider outlines the features of any incentives given in addition to the cloud service I am purchasing	n_fea_su
17. I am uncertain that the cloud service provider will have discussions with me regarding the contents of the SLA or will be inclined to drafting a cloud computing SLA specifically related to my needs before finalizing the agreement	n_neg_su
18. I am uncertain about the plans my cloud service provider has to minimize interruptions during unforeseen events and to recover from such events in the shortest possible time	n_bc_su
19. I am not certain that there is portability of data, infrastructure and applications running in the cloud from one cloud provider to another	t_port_su
20. I am uncertain about the measures my provider is taking to ensure my applications and data are secured	t_gsec_su
21. I am uncertain of the reliability of the cloud service offerings even though the service may be available	t_rel_su

SLA Asset Specificity

How important do you think these are as they relate to specifying them in the cloud computing SLA?

Items	Variables
22. Availability of the cloud computing services	t_ava_ss
23. Data Integrity of business data and information stored in the cloud	t_int_ss
24. Confidentiality and privacy of data stored in the cloud	t_con_ss
25. Support response rate relating to concerns with the cloud services or queries from customers about the cloud services being offered	n_sup_ss
26. Compensation for breaches of agreed SLA	n_com_ss
27. Definition of attributes specified in the cloud computing SLA	n_def_ss
28. Exclusions/limitations to the cloud computing services being offered	n_exc_ss
29. Expected network performance of the cloud services that are being offered	t_perf_ss
30. The expected storage capacity that is provided through the cloud	t_sto_ss

computing service

31. Maintenance or emergency activities that are executed during the periods in which the cloud service is being offered	n_mtn_ss
32. The physical security of the cloud computing facilities from which cloud computing services are being offered	t_psec_ss
33. The physical location of the cloud computing facilities where the cloud computing services are being offered	n_loc_ss
34. Engineering support outlining the amount of time that the cloud service provider will have this type of support available to its customers	n_eng_ss
35. Outcomes of information security audits and the availability or access to audit reports such as SAS70 or SSAE16 showing that periodic security audits are done on the cloud computing operations of the cloud service provider	n_soc_ss
36. How to control and manage resources in the cloud as your requirements change and this becomes necessary	t_orch_ss
37. The features of any incentives given as a result of acquiring the cloud service	n_fea_ss
38. Flexible means by which I can discuss the contents of the SLA with the provider and if necessary provide a SLA specifically designed to meet my needs	n_neg_ss
39. Plans to keep the business in operation and to recover from unforeseen disasters	n_bc_ss
40. Ability to move applications, data, and infrastructure to other cloud providers platform	t_port_ss
41. General data and network security of the cloud	t_gsec_ss
42. The reliability of the cloud services being provided	t_rel_ss

Transaction Cost (with uncertainty)

What is your perception of the level of effort required to understand how cloud service providers are providing the following in the cloud computing SLA? Use the effort scale below to indicate the level of effort required.

Items	Variables
43. To understand the availability of the cloud computing services being provided	t_ava_cu
44. To understand how the cloud service provider is providing for data integrity in the cloud	t_int_cu
45. To understand how confidentiality and privacy of the data in the cloud are protected	t_con_cu
46. To understand the support response rate that the provider is guaranteeing in the cloud computing SLA.	n_sup_cu
47. To understand how compensation for breaches is computed and	n_com_cu

how the cloud service provider rewards the user for lost service	
48. To understand the terms/attributes that are defined in the cloud computing SLA.	n_def_cu
49. To understand what the exclusions and limitations of the cloud computing SLA are	n_exc_cu
50. To understand the network performance to be expected from the cloud service provider as part of the SLA	t_perf_cu
51. To understand the amount of storage space provided by the cloud service provider as it relates to the cloud computing SLA	t_sto_cu
52. To understand what maintenance and emergency activities are and how these activities will impact the service being provided	n_mtn_cu
53. To understand whether the cloud service provider implements reasonable measures to protect the physical security of the cloud computing facilities	t_psec_cu
54. To understand where the physical location of cloud service is being provided from	n_loc_cu
55. To understand the level of engineering support that is being provided by the cloud service provider	n_eng_cu
56. To understand the frequency of information security audits and whether the cloud service provider makes reports of such audits (eg. SAS70/SSAE16) available as part of the cloud computing SLA	n_soc_cu
57. To understand how to control and manage resources in the cloud	t_orch_cu
58. To understand the features of any incentives given with the cloud service offerings	n_fea_cu
59. To understand the provision to discuss the contents of the SLA and to get the provider to configure the SLA to your specific needs	n_neg_cu
60. To understand the plans to prevent loss of operation due to unforeseen events such as natural disasters and to recover from these events in the shortest time possible	n_bc_cu
61. To understand how data, applications, and infrastructure can be moved from one cloud service provider to another	t_port_cu
62. To understand the general data and network security arrangements for the cloud service being provided	t_gsec_cu
63. To understand how the cloud service provider makes the cloud service reliable when the service is available	t_rel_cu

Transaction cost (with specificity)

What is your perception of the level of challenge or difficulty introduced into the cloud computing SLA as a result of specifying, or NOT specifying, the following in the SLA?

Items	Variables
64. Specifying the availability of the service to be expected in the cloud computing SLA	t_ava_cs
65. Not specifying how data integrity will be safeguarded in the cloud computing SLA	t_int_cs
66. Not specifying how confidentiality and privacy are protected in the cloud computing SLA	t_con_cs
67. Not specifying the support response rate to be expected from the provider in the cloud computing SLA	n_sup_cs
68. Specifying what compensation for breaches is and how compensation for breaches is administered in the SLA	n_com_cs
69. Not defining the primary terms or clauses of the cloud computing SLA	n_def_cs
70. Not specifying what are excluded from the cloud computing SLA or the limitations of the SLA	n_exc_cs
71. Not specifying the network performance to be expected by the provider in the cloud computing SLA	t_perf_cs
72. Not specifying the amount of storage to be expected in the cloud computing SLA	t_sto_cs
73. Not specifying how maintenance and/or emergency activities will be dealt with by the provider in the cloud computing SLA	n_mtn_cs
74. Including details of how the physical security of the cloud computing facility is safeguarded by the provider in the cloud computing SLA	t_psec_cs
75. Not specifying the physical location of the cloud computing facility from which the service is being provided	n_loc_cs
76. Specifying the level of engineering support to be expected from the cloud service provider over the life of the agreement	n_eng_cs
77. Commitment to conducting routine audits and making the reports (such as SAS70/SSAE16) available to users of the cloud computing service	n_soc_cs
78. Not specifying how I can control and manage resources in the cloud	t_orch_cs
79. Specifying the features of any incentives given for the cloud service being acquired	n_fea_cs
80. Not specifying that I can have discussions with the provider about the contents of the SLA	n_neg_cs
81. Specifying plans for continued operations during unforeseen events such as natural disasters and to recover from these events in the shortest possible time	n_bc_cs
82. Specifying how data, infrastructure and applications may move	t_port_cs

Items	Variables
from one cloud to another if this becomes necessary	
83. Not specifying how general data and network security of the service will be provided	t_gsec_cs
84. Specifying how the reliability of the service will be guaranteed by the provider	t_rel_cs

Intention to Adopt (with uncertainty)

In your opinion, which of the following are you not clear about in the cloud computing SLA and as a result makes it difficult for you to work with the SLA or use cloud computing services?

Items	Variables
85. I find the SLA more difficult to work with when I am not clear about the availability of the service	t_ava_au
86. I find the SLA more difficult to work with when I am not sure how the provider maintains the integrity of the data stored in the cloud	t_int_au
87. I do not have a problem working with the SLA whether or not I am clear about aspects of how the cloud service provider safeguards the confidentiality and privacy of business information and data stored in the cloud	t_con_au
88. I find the SLA more difficult to work with when I am unclear about the support response rate that will be received from the cloud service provider	n_sup_au
89. SLAs are more difficult to work with when I am not sure about what I am getting for compensation for breaches	n_com_au
90. I find the SLAs more difficult to work with even when the terms within the SLA are clearly defined	n_def_au
91. I find the SLA easier to work with when it clearly outlines what are excluded and the scope of the SLA	n_exc_au
92. I do not necessarily find the SLA problematic if the cloud service provider did not clearly outline what level of network performance I am getting	t_perf_au
93. I do not find it difficult to work with the SLA and use cloud computing services when I have doubts about the amount of storage guaranteed in the cloud by the SLA	t_sto_au
94. I do not find the SLA difficult to work with when I am not clear about how maintenance or emergency activities are scheduled or dealt with in the cloud computing SLA	n_mtn_au
95. I find the SLA easier to work with when I am not clear how the physical security of the cloud is managed by the cloud service provider	t_psec_au
96. I find the SLA easier to work with when I am not clear where the	n_loc_au

Items	Variables
cloud computing facility is physically located	
97. Doubts about access to and availability of engineering support do not create any difficulty for me to work with the SLA and use the cloud computing services	n_eng_au
98. I do not find the SLA easier to work with when the cloud service provider does not conduct independent routine information security audits of the cloud computing facilities and make the reports (eg. SAS70 and SSAE16) of the findings available as part of the cloud computing SLA	n_soc_au
99. I find the SLA more difficult to work with when I am not clear that I can control and manage the resources in the cloud	t_orch_au
100. I find the SLA more difficult to work with if the features of the incentives given with the cloud service are not clearly defined	n_fea_au
101. I find the SLA more difficult to work with if it is unclear that I can have discussions regarding the contents of the SLA with the provider before signing the agreement	n_neg_au
102. I find the cloud computing SLA more challenging to work with if there are no clear plans to continue operations and recover from unforeseen events such as natural disasters in the shortest possible time	n_bc_au
103. I find the SLA more difficult to work with if I am not clear that the cloud services can be moved seamlessly to another cloud provider's infrastructure if this becomes necessary	t_port_au
104. I find the SLA more difficult to work with if I am unclear about the general data and network security of the cloud infrastructure	t_gsec_au
105. I do not find the SLA easier to work with if I am clear about the level of reliability of the cloud computing service	t_rel_au

Intention to Adopt (with specificity)

What is your perspective of how the specification or inclusion of the following in the cloud computing SLA impacts your decision to work with the SLA or use cloud computing services?

Items	Variables
106. I find that I am more encouraged to work with the SLA and use cloud computing services when the SLA includes details of the availability of the service	t_ava_as
107. I find that I am more encouraged to work with the SLA and use cloud computing services when the SLA does not include details of how the cloud service provider will maintain the data integrity of business data and information stored in the cloud	t_int_as
108. I find that I am more encouraged to work with the SLA and use cloud computing services when the SLA clearly specifies the details of how the confidentiality and privacy of business data	t_con_as

Items	Variables
and information will be safeguarded	
109.I find that I am more encouraged to work with the SLA and use cloud computing services when the SLA clearly specifies the support response rate to expect from the cloud service provider	n_sup_as
110.I find that I am more comfortable with the SLA and more encouraged to use cloud computing services when the SLA specifies what I will receive for compensation for breaches and how this will be administered	n_com_as
111.I find that I am not more encouraged to work with the SLA and use cloud computing services when the SLA defines the terms that make up the cloud computing SLA	n_def_as
112.I find that I am not more encouraged to work with the SLA or use the cloud computing services when the SLA specifies the details of what is excluded from the agreement and the scope which the agreement covers	n_exc_as
113.I find that I am more willing to work with the SLA and use cloud computing services when the SLA clearly specifies the minimum network performance I am to expect	t_perf_as
114.I find that I am not more encouraged to use the cloud computing services or work with the SLA when the amount of storage to be received is specified in the cloud computing SLA	t_sto_as
115.I find that I am not more willing to work with the SLA or use cloud computing services when the cloud service provider specifies how it will schedule and execute maintenance and emergency activities	n_mtn_as
116.I find that I am more willing to work with the SLA and use cloud computing services when details of how the cloud service provider will deal with the physical security for the cloud computing facilities are specified in the SLA	t_psec_as
117.I find that I am more encouraged to work with the SLA and use cloud computing services when the cloud service provider specifies where the cloud computing facilities are located	n_loc_as
118.I find that I am not more willing to work with the SLA or use cloud computing services when the cloud service provider specifies the level of engineering support to expect in the SLA	n_eng_as
119.I find that I am not more encouraged to work with the SLA when the SLA specifies that information security audits will be conducted by the service provider and reports from the findings will be made available to users	n_soc_as
120.I find that I am more encouraged to work with the SLA or use cloud computing services when the SLA specifies how I can control and manage my resources in the cloud	t_orch_as
121.I am not more willing to work with the SLA or use cloud computing services if the provider details the features of any incentives given with the service I am acquiring	n_fea_as

Items	Variables
122.I find that I am more interested in working with the SLA or using cloud computing services when it is specified that I can discuss the contents of the SLA with the provider before entering the agreement	n_neg_as
123.I find that I am not more encouraged to work with the SLA or use cloud services when details of plans to continue operations and recover from unforeseen events are specified in the SLA	n_bc_as
124.I find that I am not more interested in working with the SLA or using cloud services when it is specified that my data, infrastructure and applications can be moved to another cloud provider if this becomes necessary	t_port_as
125.I find that I am not more encouraged to work with the SLA or use cloud computing services when the SLA specifies how general data and network security of the services will be ensured	t_gsec_as
126.I find that I am more encouraged to work with or use cloud computing services when the level of reliability to expect of services in the cloud is clearly specified	t_rel_as

Uncertainty, specificity, transaction cost, and adoption

Based on your knowledge and/or experience, how do you feel about using or continuing to use cloud computing services?

Items	Variables
127. I am encouraged to use or continue to use cloud computing services even when I am not clear about certain aspects of the SLA	uncert_u
128.I am not encouraged to use or continue to use cloud computing services because the cloud computing SLA is too difficult to understand and work with	cost_c
129.I will not use or continue to use cloud computing services when the SLA does not include certain aspects I consider important	specify_s
130.I am willing to use or continue to use cloud computing services for business related purposes regardless of how I feel about the SLA	adopt_a

Note

The complete questionnaire is available on request. Due to the number of pages constraint, the questionnaire was not included in this submission.

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HOW A HIGH-INCOME TAXPAYER MAY AVOID THE SUSPENSION OF BUSINESS LOSSES - TREATED AS PASSIVE ACTIVITY LOSSES - BY SATISFYING TREAS. REG. § 1.469-1T(e)(3)(ii)(C), I.E, THE EXTRAORDINARY PERSONAL SERVICES EXCEPTION TO THE PASSIVE ACTIVITY LOSS RULES UNDER I.R.C. § 469

By Brad Johnson, Francis Marion University

The purpose of this presentation is to enhance the awareness of the high-income taxpayer as to how to avoid the suspension of business losses – treated as passive activity losses - by satisfying Treas. Reg. § 1.469-1t(e)(3)(ii)(c), i.e., the extraordinary personal services exception to the passive activity loss rules under I.R.C. § 469. To qualify for § 469's extraordinary personal services exception, the high-income taxpayer must be able to offer competent evidence that (1) the high-income taxpayer provided to tenants what the law deems to be extraordinary personal services, (2) tenants rented the properties to receive the services provided by the high-income taxpayer, i.e., that the tenant's having a place to live was just an "incidental" benefit to the receipt of the services provided to the tenant by the high-income taxpayer, and (3) the high-income taxpayer "materially participated" in her rental business. In a case study approach, the three primary objectives of this article are: (1) To establish the factual background surrounding the case study; (2) To establish the law at issue (i.e., the federal tax law concerning the extraordinary personal services exception to the passive activity loss rules under I.R.C. § 469); and (3) To apply the law at issue to the factual background for the purpose of identifying implications for the high-income taxpayer in avoiding the suspension of business losses – treated as passive activity losses - under the passive activity loss rules of I.R.C. § 469.

IBM's Watson Analytics,

Session Chair: Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Presenter:

Wesley Strom, IBM, wstrom@us.ibm.com

Abstract: This session will consist of an introduction to Watson Analytics, an all-in-one tool unlike the traditional analytics tools in the academic marketplace. The session will demonstrate how it can be used to introduce students to predictive analytics without learning deep analytics tools like SAS, SPSS or R.

Session Description:

Use of Watson Analytics, an IBM developed analytics product, will be demonstrated in this session. Watson Analytics is an All-in-One Tool unlike anything out in the Academic marketplace. While it's not intended to replace deep traditional analytical tools taught in school like SPSS or SAS, it's a good way to introduce predictive analytics to students and non-analyst type students. Watson Analytics puts analytical skills in the hands of students outside the traditional analytics degree programs.

With Watson Analytics, you can:

- Use natural language processing to explore your data by choosing a question provided to you or typing one in English and getting answers.
- Quickly assemble key insights as visualizations or infographics and turn them into powerful stories that elegantly and effectively communicate your points.
- Explore data and insights to the maximum by getting insights into the insights and using predictive and cognitive analytics capabilities to discover the drivers that matter most and much more.
- Analyze Twitter data to understand social sentiment and spot external trends that could affect your field.

IBM provides many different enablement methods for instructors that include:

YouTube videos (<https://www.youtube.com/channel/UC6D7Ekh27J6Axp9BNKyLQ3w>)

Resources (<https://community.watsonanalytics.com/resources/>) and

Big Data University (<http://bigdatauniversity.com/>).

HOW CAN PROFESSORS STAY INVOLVED IN ACADEMIA AFTER RETIREMENT? OR DO THEY WANT TO? A SYMPOSIUM

Robert A. Herring III
Winston-Salem State University
Faculty of Business
RJR Building
Winston-Salem State University
600 Martin Luther King Jr. Boulevard
Winston-Salem NC 27110
(W) 336-750-2338
(C) 336-708-1038
E-mail: herring@wssu.edu

ABSTRACT

The symposium addressed the academic and professional engagement of college and university professors in retirement. Perspectives of those recently retired as well as those approaching retirement were presented and discussed. The emphasis of the symposium was on audience participation and a guided discussion of the various issues and opportunities to be faced in remaining engaged in retirement.

THE SYMPOSIUM

A number of members of the SE Decision Sciences Institute (SEDSI) are facing “the Big R” in the upcoming years, some in just a year or two. By “the Big R” I am referring to retirement. Some have recently retired.

The panel consisted of several SEDSI members, with a mix of those planning retirement in the next few years, and those retired in the past few years. Panel members gave brief opening statements, with the emphasis of the session on participation by the audience, facilitated by the panelists.

The general objectives of the panel were a sharing of personal ideas, plans, and experiences regarding retirement, seeking ideas about retirement activities that allow for retaining

involvement in academia in some fashion, and for individuals to learn perspectives from others that they may not have considered. The topics below were discussed.

Many of us have considered SEDSI a very important part of our academic careers in a number of ways. This has been more than strictly professional; the networking and friendship support system is very important as well. Are there meaningful ways to remain involved in SEDSI after retirement? What would these consist of?

Others may be ready to move on to other involvements and to leave academia behind. It would be of interest to learn from them what types of activities they contemplate that would provide meaning to their retirement years. Perhaps some want to be professionally vs. academically involved in their discipline, such as being a Baldrige examiner, for example. The input of participants in the audience who have retired provided a valuable perspective.

A plethora of issues were addressed in the panel discussion such as:

What types of academic involvement can retired professors engage in? All three of the traditional faculty categories of teaching, research, and service are engaged in by retired professors. For example, some may wish to stay involved in teaching by teaching courses as an adjunct. Others may continue streams of research in which they have been involved, perhaps with colleagues; or perhaps write books. Others provide volunteer service to their institutions, or to academic organizations such as the SE Decision Sciences Institute.

Conceptual background for the session was provided by the following references: Fishman [2] conducted an in-depth study of 14 emeritus faculty members in 2009. They were engaged in a wide variety of academic and professional pursuits, including in the work in the areas of teaching, research, and service, as well as consulting. An interesting project planned by one upcoming retiree was to compile and maintain an up-to-date alumni contact list, as task for which the college's advancement office had difficulty doing because of other more immediate duties. However, this would allow her to work at her own pace and make a valuable contribution. Phased retirement programs, offered by many universities [2] are an attractive transitioning option for some.

Remaining active in some meaningful activity in retirement has been found by many to be important to the well-being of retired persons in general. For example, Buford [1] interviewed 100 high-profile persons (not just academics) who were engaged in a wide variety of pursuits in retirements. Many of these individuals related that their friends and colleagues who did not remain active often developed health problems, and even died prematurely!

Another question a faculty member needs to decide is *when* it's time to retire. In a roundtable discussion at a management teaching conference [3] facilitated by recently retired members of the organization the question was asked "How do I know when it's time to retire?" The response was "You'll know!" The implication being that a professor will have an intuitive sense of when it's time to move on to other pursuits.

The examples above are only some of which retired professors might find desirable and challenging.

In conclusion, given the tight-knit nature of SEDSI, the discussion was valuable, relevant, and enlightening for the participants.

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A PATIENT COMMUNITY IN SILICO FOR SIMULATION OF MAJOR DISEASE EPIDEMIOLOGY, PROGRESSION, AND COMPLICATIONS: EFFECT OF PROPHYLAXIS, TREATMENT, AND AGING

Matt Campbell, Ph.D., University of South Alabama, School of Computing, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-461-1602, mattcampbell@southalabama.edu
Abu Al-Mehdi, M.D., Ph.D., University of South Alabama, College of Medicine, 5851 USA Drive N, MSB 3136, Mobile, AL 36688, 251-460-6704, mehdi@southalabama.edu
Susan LeDoux, Ph.D., University of South Alabama, College of Medicine, 5851 USA Drive North, MSB 1005, Mobile, AL 36688, 251-460-7174, sledoux@southalabama.edu

ABSTRACT

Development of clinical expertise and improvement in patient safety can be accomplished by a physician only after prolonged experience with disease management while maintaining a life-long learning aptitude. In the current system of medical education with live patients, standardized patients, or human simulators, it is impractical to expose students to this longitudinal learning process because of the brevity of encounters and temporal limits of the educational experience. We hypothesize that a virtual patient community in silico with time-machine capabilities to control natural history, prophylaxis and treatment, and incorporating neural network-modeling with individual patients as nodes and epidemiologic, pathogenetic and other factors as connectors and incorporating elements of artificial intelligence would allow the students to follow the progression of major diseases through the lifetime of their virtual patients and to experience the effects of their management within the first three years of their study.

INTRODUCTION

While the public expects the physicians who treat them to be well-trained and highly skilled, few would volunteer to be treated by future physicians just entering medical school. This creates a catch-22 situation in which people want to be treated by experienced physicians, but physicians must first treat people in order to obtain experience. Although students are generally in medical school for four years, they generally do not start clinical rotations until their third year. Current simulation tools used in medical education usually involve a single patient over a short time frame which is not a good representation of the doctor-patient relationship for most physicians. Ideally, medical students need to start practicing their diagnostic and prescribing skills as early in their medical education as possible, but how can this be done without putting patients at risk?

To address this problem, we are proposing a simulation-based training system for medical students. This system would allow each medical student to interact with numerous virtual

patients and to follow their progression over an extended period of time. The objectives of this project are as follows:

1. Develop an application that simulates a human community with controllable attributes of age, ethnic mix, height and weight and other parameters such as profession and geographic distribution representative of the US population. The software will have a population database, a disease and management database with electronic health records-type attributes, as well as a web-based student and instructor interface.
2. Model epidemiological, clinical, prophylactic and treatment parameters of obesity, hypertension, diabetes and atherosclerosis, including coronary artery disease and stroke, among appropriate number of individuals of the virtual patient community.
3. Build progressive dynamism in the life of individual virtual patients and subpopulations of adjustable size based on natural history, prophylaxis and treatment of diseases so that each student can follow a group of virtual patients throughout their lifetimes.
4. Evaluate the effect of the use of the Patient Community in silico on student performance using competency criteria for Entrustable Professional Activities (AAMC, 2014) and standardized test exams.

METHODOLOGY

In this project, we propose to create a software system tentatively named as the “Patient Community in Silico” that would provide medical students with a quasi-realistic clinical experience over a long term period (e.g. three or more years) starting from the very first days of their medical training without risk to human patients. The major two software components of the Patient Community in silico are the Clinical Population Generator which creates the virtual patients and assigns their characteristics and the Clinical Encounter Simulator that manages the students’ interaction with each patient and the patients’ progression over time.

Clinical Population Generator (CPG)

The Clinical Population Generator works to dynamically create a population of virtual patients for study within the context of the medical school curriculum. The instructor will be able to specify the gender and age distributions of the community. The instructor will also be able to specify diseases and medical conditions that will be automatically assigned to individuals in the population according to specified distributions and other instructor-specified rules. It is important to note that some virtual patients may be assigned multiple conditions while other may not be assigned any at all.

In addition, personality traits such as open/closed, friendly/hostile, and likelihood of adherence to medical advice will be randomly assigned by the CPG. Other assigned characteristics include health insurance status. Age, gender, and race appropriate photos representing each virtual patient generated by the CPG will be automatically assigned from a collection of donated and purchased photographs. To provide fresh content and to reduce the chance that students will be tempted to share answers from one year to the next, the system will be able to generate a new clinical population for each new class of medical students.

The size of the patient population can be specified by the instructor to fit the needs of the students. It is anticipated that an average size population will be approximately 5,000 individuals. It is not necessary that every virtual patient have interaction with a medical student. The intent is to have a large enough population to provide many different types of patients to meet the various needs of the class.

Clinical Encounter Simulator (CES)

The Clinical Encounter Simulator allows students to interact with individual patients from the dynamically produced clinical population.

Aging of Patients and Progression of Diseases

All virtual patients in the community will age and progress through their diseases appropriately; either in real time or at a rate specified by the instructor. For instance, the instructor may choose to have patients age 1 year for every month students spend in class.

Student-Patient Interaction

The system will allow for the student to conduct a text-based patient interview with each virtual patient. For instance, the student should be able to select a virtual patient for interviewing and the virtual patient would be able to respond to standard patient interview questions such as “What brought you to the clinic today?”, “What seems to be bothering you?”. The virtual patient will be able to respond to questioning according to their medical condition(s), personality type, gender, and age. For instance, an elderly virtual patient may choose not to disclose some symptoms to a young physician depending on the openness trait of the virtual patient. A patient may also forget to mention a drug that they are currently taking. An infant or a comatose adult would not be able to respond at all.

Diagnostic and Treatment Options

The student will be able to order a wide range of laboratory tests and diagnostic procedures for the virtual patient and receive appropriate results based on current practice. Test results can be automatically generated by the system from a database or may be manually inserted by the instructor in order to test a specific skill or present a specific situation. Treatment options may or may not be constrained by a specific patient's health insurance. In addition to treating existing diseases, the software will also allow students to prescribe prophylactic medications, including immunizations.

Patient Outcomes

Conditions of the virtual patients may improve or worsen based on the treatment ordered by the medical student and the natural progression of the disease. For instance, administration of a beta-blocker may help a virtual patient with hypertension; however, the patient may require additional classes of antihypertensive agents a few months later. The software will be sophisticated enough to produce treatment outcomes based on statistical evidence, development of an unexpected complication, or instructor's whim. The virtual patient can be programmed to die from a complication irrespective of the student's treatment 'by the book'.

This system will exploit the harmlessness of iatrogenic errors in a virtual world to improve patient safety in real life.

Interface Design

Medical students will be able to interact with virtual patients through a web-based application. Students will be able to write patient notes, order labs and treatment, and receive lab results through a web-based specially-designed electronic health records (EHR) system. The format of the patient interview documents and patient notes will conform to the USMLE Step 2 Clinical Skills examination standards.

Student Learning

In order to improve efficacy and patient safety, instructors will be able to customize the amount of disease-management hints provided to the students based on evidence-based practice and on the student's performance level. We envision that each student will be assigned a subset of patients from the community that they will follow throughout their medical school education. This will allow students to see the progression of certain diseases over time instead of scenarios with limited temporal scope presented via real patient, standardized patient, or a human simulator encounter. As the database of diseases incorporates more disease types, students will be assigned virtual patients with clinical conditions that coincide with the topics being covered in their organ-system based curriculum, which has been recently implemented at the University of South Alabama College of Medicine.

Student Assessment and Progression

Instructors will be able to follow the basic science knowledge application, clinical skills, problem solving abilities, and management accuracy of each student over time. These performance parameters of a student in the virtual world will help create a set of criteria for individualized pace of learning and for promotion based on development of competencies in Entrusted Professional Activities.

Expected Outcomes

It is expected that the proposed Patient Community in Silico will provide the students with a highly immersive learning environment of clinical medicine. We do not anticipate any major hindrances to adapting to a virtual world, taking into account the exposure of modern young generation to the digital world through a variety of gaming and interactive software. We anticipate that the use of proposed virtual environment from the first days of medical school will greatly enhance learning, result in better standardized exam outcomes and build competencies in Entrusted Professional Activities.

DISCUSSION

Accelerating Change in Medical Education

This project aims to accelerate change in medical education in the following manner:

1. New system of teaching and assessing key competencies: The Patient Community in Silico is a highly innovative approach to expose students to a dynamic disease model reacting to lifetime progression, treatment, and prophylaxis that is otherwise unavailable to them until they spend a significant part of a physician's lifetime in actual practice. The proposed system would help optimize their learning environment.
2. Individualized life-long learning: By getting into the experience of managing a patient through the lifetime of his/her disease with increasing complexity that adjusts to the educational level of the student, the student becomes adapted to the necessity of continual learning.
3. Narrow the gap between what is learned and what is needed: The management of a virtual patient that is to be rendered as realistically as can be provides the student with repeated opportunities of experiencing what works and what does not. This will facilitate the development of an appreciation of evidence-based medical practice from the very early days of their medical career.
4. Improving patient safety: Mistakes are great educators. By having an opportunity to make mistakes in the virtual world, the students will be expected to avoid them with real patients.

Novelty and Comprehensiveness of Approach

The proposed project will impart highly visible novelty to a modern medical education curriculum in several different ways:

1. Novelty in structure: A digital patient community, with programmable attributes that react and evolve incorporating elements of artificial intelligence with a user-friendly web-based interface.
2. Novelty in approach: A longitudinal follow-up of a virtual patient through the progression of the disease through aging and demonstrating the effects of physician action.
3. Novelty in learner-faculty interaction: Instruction through the use of the proposed Patient Community in Silico will provide a new platform of highly active and interactive form of learning.
4. Novelty in presentation: Whereas patients, standardized patients, and human simulators can demonstrate a temporally limited span of a disease manifestation without being able to evolve, the highly customizable and intentionally unpredictable course of the disease progression in the proposed project makes it more realistic and one of the most comprehensive simulations.
5. Generalizability: Since this project is software based, it can be easily transferred to and implemented in any curriculum of any medical school. It will have the appropriate educator's interface for modification and will require minimum learning for adapting it to different groups of diseases.
6. The proposed project will greatly facilitate the newly implemented "active learning-centered" curriculum in the University of South Alabama College of Medicine by virtue of its highly interactive, evolving character. The Patient Community in silico will help prepare students for the USMLE Step 2 CS exam as well as serve as a training platform for the Computer-based Case Simulation of the USMLE Step 3 exam.

Potential Issues

We expect to encounter some difficulties during our project. One of the most difficult issues we anticipate will be the difficulty in modeling co-morbidities to produce a realistic result. If a patient has two conditions and both individually increase body temperature by three degrees on average, should the system display a body temperature of six degrees over normal? Likewise, if a patient has two conditions that change body temperature, where one condition causes an increase of three degrees and the other causes a decrease of three degrees, should the patient have a normal body temperature? There are two examples, but many other similar situations are possible.

Since each disease can manifest itself differently in each patient based on a number of factors, we anticipate that it will be quite labor intensive to create new disease profiles. While our system will contain information on only a handful of diseases during development, we expect that faculty using the system will want to add additional diseases to the database. This could be especially time consuming.

Lastly, a short-coming of our system is that it contains no mechanism for improving bedside manner.

Since these patients are virtual in nature, medical students will not be able to improve the interpersonal skills that are generally referred to as “bedside manor” while working in the system. This emphasizes the fact that, while simulation systems such as this one can play an important role in medical training, it cannot totally replace the need for face-to-face interaction between medical students and patients.

Evaluation Plan

We plan to assess improvement in student competency using criteria for Entrustable Professional Activities [1]. Also, we will compare the miniboard and USMLE exam results of the first three years of the medical school before and after implementation of the Patient Community in silico. Results of the study will be submitted for publication.

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IMPLEMENTING INFORMATION SYSTEMS MANAGEMENT INTO HEALTHCARE PRACTICES TO OPTIMIZE MEDICARE EFFICIENCY

Rebecca A. Scott
University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403-5611
910-962-7533
scotra@uncw.edu

Jeff Cummings
University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403-5611
910-962-3032
cummingsj@uncw.edu

Information systems have become an integral part of organizations seeking to achieve efficiencies and quality in a variety of industries. The healthcare industry is no exception especially as the industry shifts to a predominately information systems focus for tracking and treating patients. This shift has accelerated with the introduction of the Affordable Care Act. With over 100 sections falling under Title III (Improving Quality and Efficiency of Health Care), the Affordable Care Act (ACA) has impacted the way healthcare professionals track and interact with patients. Healthcare practitioners and administrators must focus on efficiency from the point at which the patient establishes care through the process of filing with insurance. An additional outcome from the ACA has been the establishment of Accountable Care Organization (ACO) for Medicare practices to increase quality and efficiency of care. ACOs are groups of coordinated healthcare providers who agree to be accountable for quality, cost and overall care of Medicare patients. However, the challenge with ACOs is the coordination and execution of these guidelines. The use of information systems management is an essential approach in meeting these requirements. This paper examines how information systems impact the efficiency of healthcare practices, specifically the optimization of Medicare efficiency. The objective of this research is to explore how healthcare providers seek to meet the requirements of the ACA while maximizing efficiency and customer service. Empirical data, a discussion panel, and interviews from a large, private medical physician's office are used. This research provides insights into the challenges of transitioning physicians' offices to achieve and maximize efficiencies with the ACO through the use of information technology. An important contribution of this work is to identify and expand on best practices for meeting both ACA requirements and ACO guidelines through the use of information systems that can be implemented into other healthcare practices with the potential to influence quality and efficiency in healthcare.

ANSWERING THE \$64,000 QUESTION: A MODEL OF PHYSICIAN-OWNED CLINIC EHR ADOPTION

Matt Campbell, Ph.D., University of South Alabama, School of Computing, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-461-1602, mattcampbell@southalabama.edu
Dina Shretha, University of South Alabama, School of Computing, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-460-3690, ds607@jagmail.southalabama.edu
Amy Campbell, MSN, University of South Alabama, College of Nursing, 5721 USA Drive N., Room 3068, Mobile, AL 36688, 251-445-9400, amycampbell@southalabama.edu

ABSTRACT

Existing models of electronic health records (EHR) adoptions in literature only consider in-patient hospital settings and do not focus on the ambulatory setting. There are many similarities between hospitals and physician-owned clinics, but there are also a number of important differences that necessitate special consideration. While factors for EHR adoption in hospital settings have been studied in a holistic way, factors impacting the ambulatory environment have been examined in a piecemeal fashion with each study focusing on just a few factors in isolation. This paper proposes a comprehensive model of EHR adoption in the ambulatory physician-owned setting.

INTRODUCTION

As part of the HITECH Act healthcare reform, providers must adopt EHR systems and provide enhanced patient care to avoid monetary penalties, [14]. EHR systems help to improve quality of care by facilitating the process of data entry, processing, and retrieval and storage [12] [18]. This standardized and centralized data enables decision support which in turn enhances patient-management in a healthcare organization [4], and reduces the risk for medical errors by providing consistent data throughout care [9][36][50].

There has been a surge in EHR adoption in all types of healthcare organizational settings due to the HITECH Act, but current literature on adoption focuses mainly on hospitals while providing sparse information about the factors involved with EHR adoption in physician-owned clinics. Literature available on ambulatory EHR adoption is disjointed, addressing only one issue at a time related to adoption. In order to improve adoption a more thorough analysis is imperative to categorize the significant barriers and facilitators of ambulatory EHR adoption [17].

Successful adoption is even more imperative for physician-owned practices or independent physician practices than for hospital environments. Maintaining independence means increased pressure to provide high quality care to the patients they serve and providing benefits to their employees with limited resources. With 50% of physicians operating independently, successful EHR adoption is vital to the success of the practice [22].

This research has two purposes:

1. Identify potential factors that influence EHR adoption in physician-owned clinics.
2. Propose a holistic model of clinical EHR adoption in physician-owned practices.

LITERATURE REVIEW

There has been a huge push for EHR adoption aimed at healthcare professionals as the deadline for imposing reimbursement penalties by the Centers for Medicare & Medicaid Services (CMS) approaches. Reports show that 85% of hospitals have adopted EHRs with meaningful use as of 2015 [41]. A similar survey by the National Ambulatory Medical Care Survey (NAMCS) showed that 78% of office-based physicians used some type of EHR system as of 2013 [40]. While these statistics demonstrate the increase in EHR implementation rates, they do not imply an increase in the success or satisfaction rates of these systems.

Literature provides evidence that the key predictors for successful EHR adoption in hospitals are size, physicians' acceptance, and financial support from the organization [16][39]. In a comprehensive study with digital hospitals in China, [43] determined the various factors and strategies that facilitated Health Information System (HIS) adoption. They explored factors such as cost justification, organizational/peer support, user involvement for system selection, computer skill, perceived usefulness, and executive commitment, and identified the influence of each factor in all the stages of a successful EHR adoption process. However, a consistent barrier to hospital adoption is the physician's resistance to the restrictive framework of the system, disrupting patient-doctor communication and patient management [47].

Multiple studies have shown that financial barriers in ambulatory settings – such as upfront cost of the system, the ongoing maintenance costs, and the uncertainty about the return of investment – prevent or slow the adoption of EHRs [23][30][31][48]. Ford, Menachemi, and Phillips [15] argued that the financial risk of changeover costs in the event of vendor failure was also a significant barrier, whereas patient privacy and safety concerns are major limiting factors for EHR adoption [23][27][30][31][56][57].

To analyze the various factors for a successful adoption, Heeks [20] derived a design — reality gap model that provides a conceptual basis to determine the success and failure of EHR adoption. This model assessed the gap between the information assumptions and requirements of the system design and the actual information that is currently in use in the healthcare organizations. Similarly several others [19][30][57] have also emphasized the task-technology fit for EHR adoption.

Having user involvement in the system selection and adoption process helps customize the EHR system to meet the requirements of the end-users, thus increasing the familiarity and acceptability of the system [3][17][39][43]. Technical knowledge and IT training of the staff also positively influenced the EHR adoption [17][23][30][33][34][49][53]. However, lack of sufficient or proper training forces the physicians and other providers to rely on vendor support and technical assistance resulting in loss of autonomy [15] and longer hours due to an interruption in workflow, potentially contributing to physician resistance [35][8][45].

Literature indicated that perceived ease of use was one of the most significant positive factors of

EHR adoption [17][30][39]; however, EHRs are often criticized for having a rigid system that reduces provider productivity. Instead of having a more centralized information system (IS), providers have to input multiple entries into the system making them “resource intensive” and burdensome [46]. This lack of clinical productivity and disruption to workflow are two of the most heavily cited barriers of EHR adoption, resulting in physician resistance to implement EHR [28].

[17] and [30] reported that concerns regarding design and technical issues were the most frequent limiting factors identified in EHR adoption. Almost 43% considered technical aspects such as software/hardware issues, system problems and system speed a barrier to EHR adoption [30]. Standardization of EHR systems and interoperability with existing decision-support and clinical systems were found to be critical for gaining user acceptance [30][17][34][55].

Despite the research performed in this area the significant factors for EHR adoption are not very consistent. These inconsistencies might be contributed to the specific requirements of each organization, as the functionalities have to be customized for each organizational need. Consequently, there hasn't been any conclusive research for physician-owned practices.

BACKGROUND OF EHR ADOPTION MODELS

Holistic Hospital Model

In 2010 [44] presented a comprehensive adoption process model and investigated the factors that impact EHR adoption in a hospital environment focusing on three stages in EHR adoption: decision-making, system implementation, and system assimilation. The study examined primary factors such as “government support”, “cost justification” and “national IT standards and regulations” which were identified as crucial factors to the impact of adoption at the decision-making stage. “Organizational size and slack resource” and “user involvement” were important factors in the system implementation phase; and lastly, “organizational/peer support”, “computer skill” and “perceived usefulness” were found to be crucial factors in the system assimilation stage. Furthermore, the study identified “culture” and “executive commitment” as fundamental factors that impacted all three stages of the adoption process [44].

Overview of the basic existing ambulatory models

Many empirical studies have been conducted on the adoption factors for ambulatory settings, yet no exploratory models exist in the current literature to demonstrate the impacts of these factors for a successful EHR adoption. In the study performed by [23], the characteristics of the imminent ambulatory EHR adopters were examined in light of the five critical barriers: financial, workflow, technical, privacy concerns and personal. Financial barriers included start-up costs and on-going costs of the EHR systems. Workflow barriers included training and loss of productivity and efficiency in the clinical processes. Technical barriers included lack of technical support, lack of uniform standards and technical limitation of systems; personal barriers included dissatisfaction with practice situation, lack of computer skills, lack of time to familiarize with the systems, and physicians/clinicians resistance [23].

Table 1. Overview of factors and barriers of EHR adoption in different settings			
Adoption Factors	Author	Organizational Setting	Supported
Professional autonomy	(Ford et al., 2006)	Small practices	Yes
a) Start-up financial costs b) Ongoing financial costs c) No ROI	(Menachemi et al., 2007b)	Ambulatory Practice	Yes
	(Ford et al., 2006)	Small practices	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
	(Torda et al., 2010)	Small practices	No
	Simon et al., 2007)	Primary care and Specialists	Yes
	(Kaushal et al., 2009)	Ambulatory Care	Yes
	(Menachemi et al., 2007)	Systematic literature review in healthcare practices (Canada)	Yes
Privacy and Security Concerns	(McGinn et al., 2011)	EHR adoption in Healthcare	Yes
	(Loomis et al., 2002)	Multi-specialty practices	Yes
	(Zandieh et al., 2008)	Ambulatory Care	Yes
	(Kaushal et al., 2009)	Systematic literature review in healthcare practices (Canada)	Yes
	(Morton & Wiedenbeck, 2009)	Academy-based Healthcare System (University of Mississippi Medical Center)	Yes
User Involvement in System Selection	(Gagnon et al., 2012)	Systematic literature review in Healthcare practices	Yes
	(Simon et al., 2007)	Primary care and Specialists	Yes
Resistance from physicians	(Zandieh et al., 2008)	Multi-specialty practices	Yes
	(Kaushal et al., 2009)	Ambulatory Care	Yes
	(Morton & Wiedenbeck, 2009)	Academy-based Healthcare System (University of Mississippi Medical Center)	Yes
	(Gagnon et al., 2012)	Systematic literature review in Healthcare practices	Yes
Perceived Ease of Use	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
	(Morton & Wiedenbeck, 2009)	Academy-based Healthcare System (University of Mississippi Medical Center)	Yes
	(Gagnon et al., 2012)	Systematic literature review in Healthcare practices	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
Perceived Usefulness	(Peng & Kurnia, 2010a)	Digital model hospital (China)	Yes
	(Loomis et al., 2002)	Family Physicians	Yes
	(Lorenzi et al., 2009)	Ambulatory Care	Yes
	(Menachemi et al., 2007b)	Ambulatory Practice	Yes

	(Gagnon et al., 2012)	Systematic literature review in Healthcare practices	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
Standardization of interfaces to ensure interoperability	(Menachemi et al., 2007b)	Ambulatory Practice	Yes
	(Gagnon et al., 2012)	Systematic literature review in Healthcare practices	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
	(Torda et al., 2010)	Small practices	No
	(Ford et al., 2006)	Small practices	Yes
Loss of clinical productivity	(Simon et al., 2007)	Primary care and Specialists	Yes
	(Zandieh et al., 2008)	Multi-specialty practices	Yes
	(Kaushal et al., 2009)	Ambulatory Care	Yes
	(Gagnon et al., 2012)	Ambulatory Practice	Yes
	(Menachemi et al., 2007b)	Primary Care Physicians/	Yes
	(Menachemi et al., 2007a)	Ambulatory Care	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada) -	Yes
	(Ford et al., 2006)	Small practices	Yes
	(Lorenzi et al., 2009)	Ambulatory Care	Yes
	(Kaushal et al., 2009)	Ambulatory Care	Yes
Lack of technical knowledge/ Training and IT support	(Torda et al., 2010)	Small practices	No
	(Menachemi et al., 2007a)	Primary Care Physicians/Ambulatory Care	Yes
	(Simon et al., 2009)	Physicians in Massachusetts	Yes
	(McGinn et al., 2011)	Systematic literature review in healthcare practices (Canada)	Yes
	(Zhang & Patel, 2006)	User groups included physicians, nurses, pharmacists, and medical archivists, managers and patients.	No
	(Ammenwerth et al., 2006)	EHR adoption in Healthcare	Yes
	(Ford et al., 2006)	Small practices	Yes
	(Torda et al., 2010)	Small practices	No
	(Kaushal et al., 2009)	Ambulatory Care	Yes

What is missing?

To address the lack of a holistic predictive model, this paper aims to propose a model that specifies the significant factors that influence EHR adoption in ambulatory settings. As a result, an EHR adoption model following the Technology Acceptance Model (TAM) is presented in the section below.

MODEL

Compiling findings from a review of previous studies, we have constructed a comprehensive model of behavioral intention to adopt an EHR system among physician owners in the ambulatory environment. The model (depicted in Figure 1) is described in detail below.

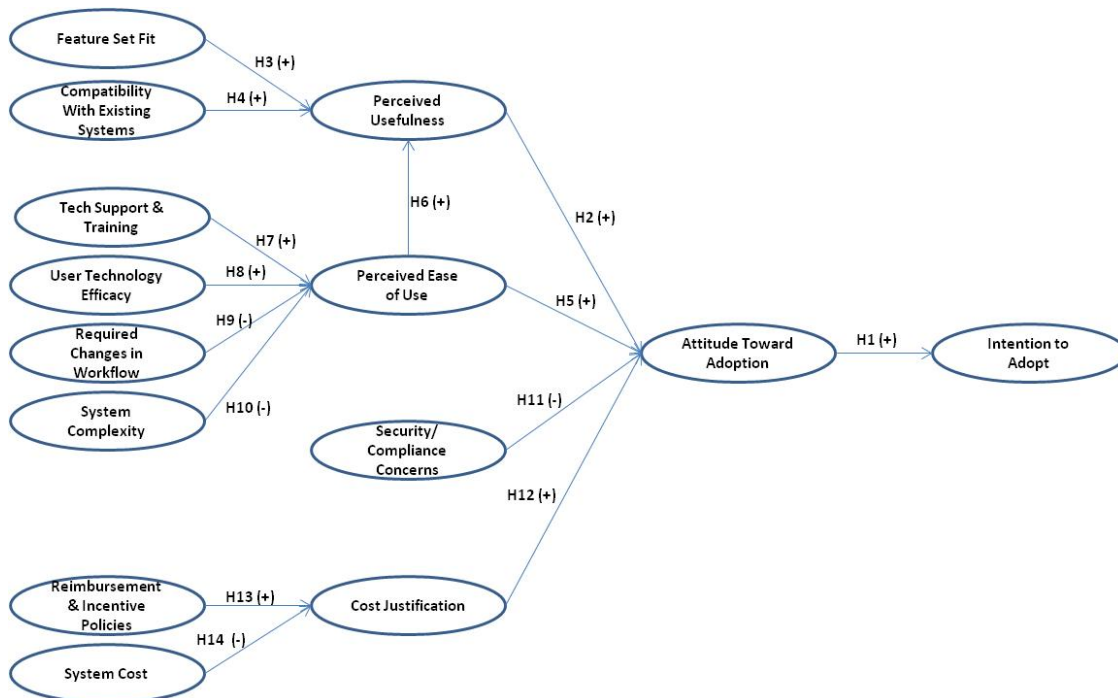


Figure 1: A model of intention to adopt an EHR system among physician owners in the ambulatory environment.

Attitude Towards Adoption

According to Davis [10], the TAM postulates that perceived ease of use and perceived usefulness influences the attitude of the users' acceptance of the IS. The model proposes that the user will be more likely to accept and use the IS if they believe that the system will improve the efficiency and quality of their performance. IS is comprised of users and their work processes; therefore, it is important to examine the user's attitude and the intended behavior that affects the actual system use [39]. Security concerns and the cost of the system is also important to consider, as these are often the two most often

identified barriers to adoption noted in literature [23].

H1: Attitude towards EHR adoption is positively related to intention to adopt an EHR system.

Perceived Usefulness

Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her performance” [10]. [39] found that perceived usefulness had a direct impact on attitude concerning the EHR adoption, and [30] found it was a critical factor in the user’s motivation to adopt.

H2: Perceived usefulness is positively related to attitude towards EHR adoption.

Feature Set

[17] found technology that is practical and appropriately matched to the user’s needs facilitates the technology’s adoption. Similarly, EHRs that facilitate data entry, are more accessible, save time, and reduce clinical errors improving the productivity of physicians and increasing daily clinical flow. As a result of these improvements, patient care becomes more efficient and physician satisfaction with the technology improves [12][17].

H3: Feature set fit is positively related to perceived usefulness.

Compatibility with Existing Systems

Physicians who already have a practice management system or other technology-based solutions in use in their practices must find an EHR system that will work with their existing solutions or replace the existing solutions with ones that are compatible with their chosen EHR [17][30][34][54].

H4: Compatibility with existing systems is positively related to perceived usefulness.

Perceived Ease of Use

Perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of effort” [11, pg320]. In a study conducted by [39], the authors used structural equation modeling and found that perceived ease of use had the strongest impact on perceived EHR usefulness. A later study found that users perceived EHRs which had a low learning curve and those which could seamlessly fit into the existing clinical workflow as ‘easy to use’ [39].

H5: Perceived ease of use is positively related to attitude towards EHR adoption

H6. Perceived ease of use is positively related to perceived usefulness.

Tech Support and Training

Having vendor support is one of the key factors to obtaining success while implementing an EHR. Since most ambulatory practices do not have technical support within the practice, they have to rely on the vendor’s support and consultation for all the problems associated with EHRs [5]. With the available vendor support, physicians are able to transition from EHR implementation to achieve meaningful use and resolve any issues

they may come across [52].

Lack of training is one of the most commonly cited organizational factors that impede EHR adoption [31][30]. Some physicians do not have sufficient computer skills and lack the basic knowledge and training necessary to use these systems effectively [53].

Training programs should educate users on how to use the system and motivate the users by identifying the benefits of the system [5][48]. Studies showed that training sessions in computer knowledge and use of EHR software improved the fit between the users and the technology adopted by the practice [3].

H7: Available tech support and training for the clinician is positively related to perceived ease of use.

User Technical Efficacy

Providers rely heavily on EHR systems to provide them with the information and the tools required in order to deliver efficient patient care. However, this raises concern about technical issues such as loss of access to patient records due to power outage and issues with software, hardware and networking [5][30][35]. Additionally, due to a large number of vendors that provide EHR solutions, ambulatory practices are having difficulty identifying which vendor would be the best option to meet their requirements and be able to provide future technical support if needed [18][31]. Therefore we propose:

H8: Technology efficacy is positively related to perceived ease of use.

Required Changes in Workflow

EHRs have rigid systems and require multiple input entries, reducing provider productivity [46]. Interruptions in workflow and the need for technical assistance in utilizing ISs can contribute to longer hours and require additional work with the staff to redesign the clinical workflow to improve efficiency [35][45][15]. Further studies identified mindfulness and respectful interactions between personnel as being necessary factors in successful EHR adoption suggesting that these elements allowed the staff to adapt uniformly to required changes in workflow [26].

H9: Required changes in workflow are negatively related to perceived ease of use.

System Complexity

Computerized physician data entry is sometimes considered a barrier to EHR adoption since the structured data entry is restrictive and requires more work for the physicians [23]. EHRs that are poorly designed can inadvertently lead to medical errors [21] and more complex systems in cognitive overload thereby resulting in cognitive error [2]. Studies have shown that easy navigation, user-friendly screens, and uncomplicated layouts facilitated EHR adoption [30].

H10: System complexity is negatively related to perceived ease of use.

Security/Compliance Concerns

Like any other healthcare organization, ambulatory practices are also obligated to protect patient data and prevent any unauthorized user access. However, most providers feel that

that patient confidentiality could be compromised because of the increased availability of the data [5][31][39]. Similarly, in a systematic review conducted by [30] it was found physicians and related health professionals perceived that EHR use may compromise the security of patient information.

H11: Security and compliance concerns are negatively related to attitude towards EHR adoption.

Cost Justification

Many ambulatory practices are considered to be physician-owned and, therefore, have a higher financial stake in the adoption decision than do physicians in generally non-physician owned facilities such as hospitals [23]. Since many small practices fund the equipment and maintenance costs directly from the physician's income [32], the authors believe this will make a cost justification of the new system to be of the utmost importance to small ambulatory practices. Research has suggested the lack of financial incentive and ROI affect ambulatory practices more severely than larger organizations [18].

H12: Cost justification is positively related to attitude towards EHR adoption.

Reimbursement and Incentive Policies

Cost is a significant barrier to EHR adoption due to a lack in short term ROI and a high initial cost [12][6]. The presence of incentives and reimbursements, however, improved the probability for small to moderate physician offices to adopt EHRs [51][17].

H13: Reimbursement and incentive policies are positively related to cost justification.

System Costs

In a study conducted by [35], they learned that the average EHR start-up cost for ambulatory practices ranged from \$16000 to \$36000 per physician [23][35]. This type of high upfront costs for hardware and software installations were identified as barriers to EHR adoption [28]. On-going costs for EHRs included upgrading hardware/software, software maintenance, and training clinical staff; technical support and changeover costs with regards to vendor failure or system requirement change were also considered barriers towards adoption [15][28].

H14: Systems costs are negatively related to cost justification.

DISCUSSION AND CONCLUSION

Contribution of the Model

We analyzed existing literature to find relevant factors that may impact EHR adoption in physician-owned clinics and then used these finding to build a holistic model of significant factors that influence EHR adoption in ambulatory settings.

Our model provides a simple yet conclusive analysis of the determinant factors that impact EHR adoption. However, the proposed model must be tested to validate the model

and to identify any gaps in the study. Hence, a more thorough examination of the model with the empirical data must be conducted to confirm the validity and the reliability of the relationships among the various components. By laying the groundwork based on past studies this preliminary model will act as a basis for more categorical research work to be conducted in ambulatory EHR adoption.

Limitations and Future Research

This paper does not analyze any data to support the proposed model, and additional research and model evaluation is needed to further refine the success factors for EHR adoption in small office-based practices. The model should be tested and validated for further studies. The model is so large that it would be difficult to test it in a single study.

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From Introductory Statistics to Analytics

Session Chair:

Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Session Presenter:

Mia Stephens, JMP, mia.stephens@jmp.com

Abstract: An introductory statistics course class is required of nearly all undergraduate students and in an analytics-oriented world it should lay the foundation for statistical thinking and an appreciation of data-based decision making. This session offers suggestions on how data analysis software can be used to help students move from introductory statistics to analytics courses. Suggested procedures and techniques will be demonstrated using JMP statistical software.

Session description:

More than ever, universities and corporations are recognizing the value of data and the importance of analytics and the skills required to glean valuable information from their data. This is evidenced, in part, by the growing number of graduate-level programs and job postings in the field of analytics and decision science.

While analytics is “hot”, nearly all undergraduate students are required to take introductory statistics. This introductory course should lay the foundation for statistical thinking and an appreciation of data-based decision making. Yet, many introductory courses still place heavy emphasis on probability theory and the mechanics of statistical inference, with little connection to the real-world problems that are the focus of analytics. In this session we talk about the gap between introductory statistics and analytics courses, and offer some suggestions on how to better arm students in introductory courses for an analytics-oriented world using data analysis software. Suggested procedures and techniques will be demonstrated using data and JMP statistical software.

THE NATIONAL RESPONSE CENTER DATA BASE: HOW USE TO IT?

Gary Hackbarth, Langdale College of Business Administration, Valdosta State University,
1500 N. Patterson St., Valdosta, GA 31698, 229-245-3805, ghackbarth@valdosta.edu

Marko Horn, Langdale College of Business Administration, Valdosta State University,
1500 N. Patterson St., Valdosta, GA 31698, 229-259-5505, mhorn@valdosta.edu

ABSTRACT

The National Response Center Data Base is an underutilized resource presenting an opportunity to better understand the release of hazardous materials on firm market value and corporate communication strategies. Government hazardous material release data presents opportunities to directly compare the impact of environmental incidents between government agencies and private enterprise. Such comparisons may offer strategies to buffer or bridge communications with stakeholders in an effort to bolster firm reputation. A key result of using the National Response Center Database would be the identification and inclusion of variables not found in standard financial data-sets.

KEY WORDS

National Response Center Data Base, Big Data, Corporate Reputation, Corporate Communication

INRODUCTION

The National Response Center (NRC) is the United States National Communication Center, staffed 24/7, by the U.S. Coast Guard and marine science technicians. The NRC is the single point of contact for the reporting of all hazardous substance releases in the United States. Notification to the NRC hotline triggers federal notification requirements to other federal agencies in accordance with several laws. Reports to the NRC activate the National Contingency Plan and initializes the federal government's response capabilities including notification of a pre-designated on-scene coordinators whose job it is to collect available information on the size and nature of the hazardous release, facility or vessel(s) involved, and party(ies) responsible for the release (EPA, 2015). Hotline reports to the NRC are made public and are available via the NRC website (NRC.USGC, 2015).

The National Response System (NRS) routinely and effectively responds to a wide range of oil, chemical, radiological, biological, and etiological discharges into the environment. The NRS is designed to respond to hazardous substance releases using a multi-layered communication system that shares expertise and resources to ensure cleanup activities are timely, efficient, and minimize threats to human health and the environment (EPA, 2015). At the heart of this system is the National Contingency Plan (NCP) which ensures that the federal government's resources and expertise are immediately available for emergencies that are beyond the capabilities of local and state responders. When releases are serious enough to be considered "Nationally Significant Incidents," the National Response Framework (NRF) is activated. The NRF is the federal government's comprehensive, all-hazard approach to crisis management which provides a mechanism for coordinating federal assistance to state governments and localities. Importantly, the NRT is responsible for distributing technical, financial, and operational information about

hazardous substance releases and oil spills to all members of the team (EPA, 2015). It is the release of this information to not only the federal team but, the public at large that may adversely affect the corporate governance, reputation, or financial stability of the firm reporting the hazardous substance release (Horn, 2010). A more thorough understanding of the data found in the NRC database may offer insights into the financial impact of public notification of a hazard substance release on firm financial performance measures.

This research in progress begins with a brief introduction and continues with a brief overview of the firm communication environmental impact on firm performance literature and structure of the NRC database. We then continue with how the study will be conducted and descriptive results along with implications of this research.

BACKGROUND

Hazardous substance release may or may not have an effect on firm financial performance. Horn (2010) found that environmental emergencies hurt firm performance and that the size of the hazardous substance release had a negative impact on the cumulative abnormal return to the firm. Further, how well a firm communicated information about the hazardous substance release could mitigate negative returns or limit damage to a firm's corporate reputation (Horn, 2010). Other researchers find that legal penalties are only a small portion of the losses experienced by firms after a hazardous material release. The initial announcement of an enforcement action by federal regulators accounts for only a 13.09% decline in a firm's market value, in addition to the 25.24% from the announcement that triggered the investigation (Karpoff, Lee, & Martin, 2006). Legal penalizes and class action settlements explain only 8.8% of a loss in market value from announcements brought on by a hazardous material release. Firms may also lose share value through asset write-downs when firms correct misrepresentations in their financial statements. Karpoff, Lee, et al. (2008) best estimate of the average size of this accounting write-off equals 24.5% of the loss in share value. The implication is that approximately 2/3 of a firm's market loss to a hazardous spill release is due investors' expectations of impaired operations, lower future earnings, and/or higher financing costs (Karpoff et al., 2006). Reputation loss is then defined as those factors not associated with legal penalties or clean-up costs that occur as a result of a hazardous material release that result in loss of market share of a firm.

Organizations carefully craft their reputations via their mission statements, corporate visions of products and services they provide, and the organizational culture they develop over time. Corporate reputation can be defined as the trust, positive feeling, and overall admiration people have for a particular organization (Fombrun, 1996, 2001; Fombrun & Reil, 1997). Corporate reputation is an individual assessment of the outward and public perception of the emotional appeal

of the corporate image, the perceived quality and performance of products and services offered by the organization, the leadership and vision of the executive team, the outward appearance of the corporate workplace and environment in which employees work, the financial performance of the firm, and the perceived corporate responsibility of the firms stewardship of the environment and community. A hazardous material release could seriously one or all of these factors impacting the overall perceived corporate reputation.

The 2013 Global Reputation Pulse Study from the Reputation Institute found that 60% of senior executives believe reputation has a high financial impact on their company and is a driver of business value (Institute, 2013). Further, 79% agree that we are competing in a reputation economy but only 20% say they are ready to take advantage of it. The reputation economy is a new marketplace reality in which people buy products, take jobs, and make investments based primarily on their trust, admiration and appreciation for the companies and institutions that stand behind them (Institute, 2013). The concept is that good reputations lead to supportive stakeholder behavior and supportive stakeholder behavior leads to improved organizational performance. In a reputation economy, firm success is based on customers buying your products, policy makers and regulators giving you license to operate, the financial community investing in you, the media reporting your point of view, and employees delivering on the firm strategy. Hazardous material releases improperly managed could lead customers to not buying products, governments restricting your operations, limited financial flexibility, negative media reporting, and employees not delivering the firms strategy. Reputation as an intangible asset with financial implications must be carefully managed. Communication with stakeholders is key to managing adverse events such as a hazardous material release.

Organizational communication takes place at both the micro level (within organizations) and the macro level (between organizations and their external environment) with some overlap as a firms external messages are received by the internal environment as well. It is the intent of both internal and external communications to gather resources from both internal and external stakeholders to achieve organizational goals. The messages an organization creates are intended to either buffer the organization from the environment or build a bridge to the environment (B.Meznar & Nigh, 1995).

Buffering is conducted if a firm tries to avoid external interference with internal operations, by influencing the external environment in its favor to maintain legitimacy. Bridging is conducted when a firm adapts its organizational activities to conform to external stakeholder expectations. In the context of environmental protection, a firm that buffers from the external environment would communicate that the measures to protect the environment are a liability and therefore a threat to firm financial performance, whereas a firm that intends to build a bridge to protect the natural environment would communicate that the enacted measures are an opportunity to increase future firm performance.

Firms need to be legitimized by their external environment in order to continue operations which leads them to both buffer and bridge in their communication messages. In the reputation economy, firms must communicate a consistent message in how they value engagement in social issues and in their desire to protect the natural environment. The reality is that firms that routinely deal with hazardous materials will have inadvertent releases because of equipment failure, human error, or natural causes. Hazardous releases will happen despite the best efforts of all concerned. They must

prepare stakeholders for the reality that hazardous material releases will occur but, when they occur, the firm will quickly act to resolve the situation, minimize the impact to the environment, and take corrective action to limit similar mishaps in the future.

The National Response Center (NRC) database contains large numbers of understudied variables that might provide insight into how many hazardous material releases there really are, how often they occur, and which factors might better communicate to stakeholders the reality of business operations dealing with hazardous materials. Horn (2010) and Karpoff et al. (2006) are the two studies that we are aware of that used the NRC database data to look at hazardous material release impact on a firm's market value. A better understanding of the types of hazardous material releases, locations, injuries and fatalities, size of spills, reporting agencies, responding agencies, are all factors that may impact firm reputation and share value in different ways.

DATA COLLECTION

Raw data was collected from the National Response Center (NRC) website for the years 1990 through 2014. Each year consisted of ten separate spreadsheets labeled Calls, Incident_Commons, Incident_Details, Incidents, Material_Involved, Material_Involved_CR, Trains_Detail, Derailed_Units, Vessels_Detail, and Mobile_Details. These 10 worksheets were then combined into a single spreadsheet using AbleBits, an MS Excel Plugin tool, using the SEQNOS variable as a unique identifier to combine the data. The SEQNOS variable is a unique variable that identifies each individual call made to the NRC and uniquely identifies each row in each of the spreadsheets. NRS annual data had been denormalized from an unknown database format. It proved problematic to recombine each of the years from 1990 through 2014 into a single MS Excel spreadsheet. The file size was just too big to process using MS Excel (32 Bit) even with 20 GB of internal memory. Data was imported into IBM SPSS Statistics 22 for processing and analysis.

DATA ANALYSIS

The dataset from 1990 through 2014 contains 751,032 individual records with sequence numbers (SEQNOS) ranging from 1 to 1,110,662. Missing SEQNOS Numbers are assumed to be practice drills, but this has yet to be verified. There are 253 different variables many of which are empty spaces or are marked unknown. The data set contains numerous spelling and data entry errors. Data cleaning is still ongoing and data presented should be considered very preliminary.

The average call length is 7:20 minutes with a standard deviation of 11:07 minutes. NRC responders enter data quickly with the intent of gathering relevant information and disseminating information to other federal agencies. The entries are immediately locked with no option to update mistyped information other than adding a note in an appropriate section.

Table 1 reflects the source of NRC calls. It is interesting that 42.5 % of hazardous material releases have a report of unknown origin. Table 2 reflects the type of incident. Hazardous material releases due to aircraft are very small (0.6%) while FIXED (facilities) account for 37.1 % of hazardous material releases. RAILROAD and RAILROAD NON-RELEASE account for 8.7%. STORAGE TANKS 4.8%, PIPELINE 5.3%, PLATFORM 5.2%, UNKNOWN SHEEN 14.4%, and VESSEL 13.3% account for a significant proportion of hazardous material releases. It would be true that most of the releases are petroleum products, but there are releases of more

dangerous chemicals that can only be identified by analysis of other fields in the database.

Table 1: SOURCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FAX	129	.0	.0	.0
	MESSAGE TRAFFIC	3837	.5	.5	.5
	NEWS	310	.0	.0	.6
	OTHERS	119	.0	.0	.6
	TELEPHONE	406718	54.3	54.3	54.9
	UNAVAILABLE	318583	42.5	42.5	97.4
	WEB REPORT	19146	2.6	2.6	100.0
	Total	748842	100.0	100.0	

Table 2: TYPE OF INCIDENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	AIRCRAFT	4822	.6	.6	.6
	CONTINUOUS	6280	.8	.8	1.5
	FIXED	277865	37.1	37.1	38.6
	MOBILE	73384	9.8	9.8	48.4
	PIPELINE	39371	5.3	5.3	53.6
	PLATFORM	38880	5.2	5.2	58.8
	RAILROAD	36631	4.9	4.9	63.7
	RAILROAD NON-RELEASE	28403	3.8	3.8	67.5
	STORAGE TANK	35755	4.8	4.8	72.3
	UNKNOWN SHEEN	107874	14.4	14.4	86.7
	VESSEL	99577	13.3	13.3	100.0
	Total	748842	100.0	100.0	

Table 3 reflects the responsible organizational type reporting the hazardous material release. Only 58.6% of hazardous material releases can be attributed to private enterprise. A fairly large proportion of 41.4% can be attributed to government entities or groups with far less accountability than private enterprise. While identifying the impact of hazardous material releases on private enterprises impacts market share directly, we believe a better understanding of the impact of governmental agencies and how they communicate with the public may play a mitigating effect on private enterprise market share. The idea being that government agencies communicate less, hide more, and do less than the private sector in protecting our environment. No matter how bad the private sector may seem, the government has a worse record.

Table 4 reflects the incident cause. Table Four 4 also reflects the degree to which the data is dirty and needs to be cleaned. DISORDERLY PASSENGER, EQUIPMENT FAILURE, NATURAL PHENOMENON, TRANSPORT ACCIDENT, and OPERATOR ERROR are relevant examples of data entry errors that must be corrected. These corrections are necessary as the size of the data set can be reduced to include only the data that involved private enterprise and only the incident causes that can be attributed to a failure of firm governance. We also believe that it would very useful to compare the excluded data of primary government agencies across similar variables.

Table 3: RESPONSIBLE_ORG_TYPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEDERAL GOVERNMENT	15774	2.1	2.1	2.1
	FIRE DEPARTMENT	159	.0	.0	2.1
	FOREIGN AGENCY	7	.0	.0	2.1
	LOCAL GOVERNMENT	7124	1.0	1.0	3.1
	MILITARY	7062	.9	.9	4.0
	OTHER	2465	.3	.3	4.4
	POLICE DEPARTMENT	113	.0	.0	4.4
	PRIVATE CITIZEN	32430	4.3	4.3	8.7
	PRIVATE ENTERPRISE	438742	58.6	58.6	67.3
	PUBLIC UTILITY	22392	3.0	3.0	70.3
	SEA PARTNERS PROGR	2	.0	.0	70.3
	STATE GOVERNMENT	2339	.3	.3	70.6
	TRIBE	33	.0	.0	70.6
	UNKNOWN	220200	29.4	29.4	100.0
	Total	748842	100.0	100.0	

The data set also contains incident descriptions, number of fatalities, injured, responding agencies, area affected, locations, damage assessments, and the responsible company. The responsible company can be paired with financial data through its three letter trading identifier or PERMNO.

POSSIBLE RESULTS AND FUTURE DIRECTIONS

How firms communicate hazardous material releases is important to how it impacts their market value. We see opportunities to use NRC data to buffer the impact of hazardous material releases by comparing and contrasting similar data with government agencies. Companies that that cause environmental damage will experience a decrease in firm performance but maybe not as much if it can be shown that the government is a far worse steward of the environment. Reputation could be adjusted by size of the release, number of causalities, and potential financial impact.

Table 4: INCIDENT_CAUSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	AIRCRAFT DIVERSION	18	.0	.0	.0
	DERAILMENT	4937	.7	.7	.7
	DISORDERLY PASSENG	2	.0	.0	.7
	DISORDERLY PASSENGER	11	.0	.0	.7
	DUMPING	29262	3.9	3.9	4.6
	EARTHQUAKE	173	.0	.0	4.6
	EQUIPMENT FA	9584	1.3	1.3	5.9
	EQUIPMENT FAILURE	205781	27.5	27.5	33.4
	EXPLOSION	966	.1	.1	33.5
	FLOOD	477	.1	.1	33.5
	HIJACKING	1	.0	.0	33.5
	HURRICANE	5520	.7	.7	34.3
	NATURAL PHEN	729	.1	.1	34.4
	NATURAL PHENOMENON	14742	2.0	2.0	36.3
	OPERATOR ERR	3853	.5	.5	36.9
	OPERATOR ERROR	69666	9.3	9.3	46.2
	OTHER	104888	14.0	14.0	60.2
	OVER PRESSURING	1481	.2	.2	60.4
	SUICIDE	947	.1	.1	60.5
	TORNADO TRANSPORT	178	.0	.0	60.5
	AC TRANSPORT	634	.1	.1	60.6
	ACCIDENT	19079	2.5	2.5	63.2
	TRESPASSER	3789	.5	.5	63.7
	UNKNOWN	262540	35.1	35.1	98.7
	VESSEL SINKING	9584	1.3	1.3	100.0
	Total	748842	100.0	100.0	

Horn (2010) conducted an event study to look at price reaction to environmental accidents. By looking at abnormal returns, it was found that hazardous material releases, specifically oil spills adversely affected stock price. This line of reasoning can be further exploited using additional NRC variables. One premise is to assume that the total cost of NRC reportable incidents likely exceeds any legal penalty and cost associated with cleanup to offending companies (Karpoff et al., 2006). We then hypothesize that reputation cost is a function of type of incident, industry affect, relative impact of the event, volatility of the event, source of information, cause of the incident, distance to nearest city, etc. Additional control variables might be introduced such as firm size, firm age, etc.

Such an approach would provide additional insight into the impact of hazardous material releases on firm market value but would also allow for firms to measure the impact of different communication strategies to minimize any adverse financial impacts. Comparison with governmental agencies might muddy the water to reduce legal penalties and improve a firm's reputation relative to the government vice industry partners or competitors.

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THE DISTRIBUTION OF INFORMATION, THE MARKET FOR FINANCIAL NEWS, AND THE COST OF CAPITAL

Paul Marmora*

Abstract

Recent empirical evidence suggests that stocks exhibiting a greater degree of asymmetric information among investors earn higher returns. By incorporating a market for financial news, this paper presents a rational expectations model consistent with this observation. When private information about a firm is highly concentrated within a small segment of the population, few individuals expect to hold a large enough stake in the firm to warrant purchasing a copy of firm-specific news. Given increasing returns to scale in news production, these few individuals find a copy of news prohibitively expensive to purchase, which prevents them from learning more about fundamentals and therefore raises their required risk premium. This result hinges crucially on the existence of competitive information markets, which suggests that the financial news media plays an important role in determining how the cost of capital varies with the inequality of information across investors.

*Department of Economics, Randolph-Macon College. E-mail: paul.marmora@gmail.com.

1 Introduction

A long-standing question in the finance and accounting literature is how asymmetric information among investors affects a firm's cost of capital. Although a growing body of empirical evidence suggests that stocks with a greater degree of information asymmetry earn higher returns (e.g., Easley et al., 2002; Botosan et al., 2004; Kelly and Ljungqvist, 2013; Peng He et al., 2013), there is no clear consensus in the literature regarding how a less equal distribution of information across investors results in a higher risk premium. Several papers argue that asymmetric information creates a new form of systematic risk because investors command a higher premium for trading against those who are better informed (e.g., O'Hara, 2003; Easley and O'Hara, 2004; Hughes et al., 2007). However, it appears that in rational expectations models with price-taking agents, an asset's expected risk premium is only affected by the average quality of information that agents possess, not by how this quality is distributed across agents (Admati, 1985; Wang, 1993; Lambert et al., 2012).

In this paper, I explore an alternative mechanism whereby differences in the quality of information across investors can lead to higher expected returns, even if these differences are not directly incorporated into stock prices. Specifically, I argue that firms with a less equal distribution of information across investors are generally more expensive to acquire *additional* information on. This deters investors from learning more about these firms and therefore raises the risk premium that an average investor commands for holding their shares.

The intuition is tied to differences in the cost and benefit of news provision. On one hand, news production involves a high fixed cost of investigation and a near 0 cost of replication, so that the cost of acquiring firm-specific news depends on *how many* people purchase a copy—the more copies purchased, the smaller the share of the fixed cost each purchaser must bear. On the other hand, the benefit of acquiring firm-specific news depends on *how much* a person expects to invest—one piece of news can be used to evaluate multiple shares

of a company's stock. When a firm's private information is highly concentrated within a small fraction of the population, few individuals expect to hold enough outstanding shares to warrant purchasing additional firm-specific news. As a result, each prospective purchaser must incur a larger share of the fixed cost of investigation to obtain a copy, which makes it prohibitively expensive to learn more about the firm. This raises the average level of investors' uncertainty when the portfolio decision is made, which raises the firm's expected cost of capital.

To capture this intuition, I develop a three-period noisy rational expectations model with a continuum of risk-averse agents that competitively trade one risky asset. Each agent is exogenously endowed with a private prior signal about the risky asset's payoff, where the quality, or precision, of these prior signals can vary across the population. Before agents decide how much to invest, they each have an opportunity to purchase an additional news signal. I make two assumptions on the form of this news signal. First, agents purchase this news signal on a competitive information market characterized by increasing returns to scale in production. Second, an agent's ability to interpret the news signal is increasing in the precision of their priors.

In this setting, I find that a greater inequality in the distribution of prior precision across agents reduces the average posterior precision of agents' beliefs at the time of investment, which increases the asset's expected risk premium. Notably, this result is contingent on both information markets and increasing returns to learning. In fact, when the cost of acquiring the news signal is exogenously fixed, I reach exactly the opposite conclusion: a sufficiently high inequality of initial information actually decreases excess returns. The reason is that when initial information about a firm is highly concentrated, a small fraction of agents expect to hold so many shares that they are willing to acquire news even when the expected return per share is extremely low, which results in a smaller equilibrium risk premium.

These results have several implications. First, they suggest that whether the cost of cap-

ital rises or falls with a higher inequality of information in competitive equity markets rests crucially on the extent to which individuals are able to share in the cost of news production. For example, in financial markets with few media outlets, a more equal distribution of information across many investors should be associated with higher costs of capital, as no single investor expects to hold enough shares to pay the entire fixed cost of producing additional information themselves. On the other hand, a more equal distribution of information should be associated with a lower cost of capital in markets with a sophisticated news industry because stocks that many investors expect to hold will be cheaper to acquire news on.

Second, the model has implications for the reporting preferences of the financial press. Indeed, one way to interpret the mechanism driving the main result is that widely-circulated, low-cost news providers are more likely to cover stocks with a more equal distribution of information, i.e., stocks in which many investors each expect to hold a smaller number of shares. This interpretation is consistent with evidence that the mass media is more likely to cover stocks primarily owned by individual investors (e.g., Fang and Peress, 2009; Solomon, 2012). Because a more equal distribution of information is associated with more extensive media coverage, the negative relation between the equality of information and the cost of capital predicted by the model is also consistent with the growing empirical literature linking greater media coverage to higher asset prices (e.g., Huberman and Regev, 2001; Fang and Peress, 2009; Tetlock, 2010, 2011; Engelberg et al., 2012).

This paper is related to several strands of research. First, it contributes to the recent debate about whether information asymmetry among investors affects the cost of capital in perfectly competitive markets.¹ O'Hara (2003), Easley and O'Hara (2004), and Hughes et al. (2007) find that increasing the proportion of private signals to public signals endowed to agents increases an asset's risk premium, suggesting that firms with a greater degree

¹Lambert et al. (2012) shows that asymmetric information can have a separate effect on the cost of capital, but only in models with imperfect competition, like Kyle (1985).

of asymmetric information have higher costs of capital. However, Lambert et al. (2012) point out that an increase in the proportion of private to public signals only raises the risk premium because it lowers the average precision of agents' information, not because it changes how equally distributed this information is across agents. Importantly, these papers do not include an endogenous information choice, i.e., they are concerned with how an exogenous distribution of information *directly* affects returns. In contrast, the distributional effects I document arise *indirectly* via the learning decision. That is, in my model a less equal distribution of prior precision across agents results in the average agent to acquire

thereby lowering average posterior precision. The end result is that firms with a less equal distribution of precision experience a higher cost of capital, even though, consistent with Lambert et al. (2012), the risk premium is only affected by the average posterior precision of agents' beliefs.

The learning decision that agents face blends two different approaches used in the literature. In the first, agents learn by acquiring additional noisy signals about future payoffs subject to an exogenous cost (Grossman and Stiglitz, 1980; Verrechia, 1982). In my model, the precision of an agent's acquired signal is increasing in the precision of his prior beliefs, a type of increasing returns to learning that is also present in the learning constraints motivated by the information-theoretic concept of entropy, such as those used in Peng and Xiong (2006), Van Nieuwerburgh and Veldkamp (2009), Mondria and Wu (2010), and Kacperczyk et al. (2014).² In the second approach, an agent can sell noisy signals about future payoffs to other agents (Admati and Pfleiderer, 1986, 1990; Allen, 1990). Within this strand of research, my model is most closely related to Veldkamp (2006), who uses the same cost structure and

²As Sims (2006) asserts, the entropy-based learning technology is better suited to address the cost of "processing" readily available information, not the cost associated with how information is made available in the first place. Most finance-oriented papers in this literature assume that investors can reduce all asset uncertainty to arbitrarily low levels if endowed with sufficient information-processing capacity, which, in light of Sim's criticism, implies that every investor is exogenously supplied access to payoff information on all stocks.

competitive information market as the one used here to explain periodic “media frenzies” during times of heightened market volatility. However, in her paper, all agents are ex-ante homogenous and acquire news signals with equal precision, so that her framework cannot address how the cost of capital is affected by the distribution of information.

Hong and Stein (2007) provide an alternative mechanism through which news suppliers can affect asset returns. They argue that media coverage captures the attention of investors with heterogeneous beliefs, which, according to Miller (1977), drives asset prices up in the presence of short-sales constraints. In contrast, the mechanism presented here does not rely on short-sales constraints: risk-averse investors are aware that all assets exist and are free to take any position on them, but are simply less willing to hold an asset whose payoff they are more uncertain of.³

Finally, the analysis builds on Peress (2010), who shows that expanding a firm’s investor base without raising capital induces incumbent shareholders to conduct less research because they each expect to hold a smaller stake in the firm. His results are driven by the same scaling effects to the benefit of learning responsible for the results here, but there are two crucial differences. First, while Peress (2010) exogenously limits the size of an asset’s investor base (as in Merton (1987)), in this paper an asset’s ownership structure is determined endogenously from the distribution of prior information. More importantly, I include a competitive market for news, which partially offsets the risk-sharing effect he documents. That is, those who invest in a firm with a small shareholder base each expects to hold more risk, but they must also bear a higher cost of producing news.

The rest of the paper is organized as follows. Section 2 develops a noisy rational expectations model with both heterogeneous agents and endogenous information acquisition. Section 3 characterizes the model’s equilibrium. Section 4 presents the model’s main results.

³In heterogeneous noisy rational expectations models, each agent perceives a different risk-return tradeoff based on their individual information sets. Consequently, unlike the homogenous information setting of the CAPM, agents differ in their assessment of what constitutes an optimally diversified portfolio.

Section 5 reviews existing empirical literature that supports the model's predictions. Section 6 concludes and offers direction for future research.

2 Model Setup

2.1 Timeline and Assets

In this paper, I analyze how the initial distribution of asset information across investors affects how much additional asset-specific news is produced. To do so, I develop a general equilibrium noisy rational expectations model with a continuum of heterogeneously informed agents of measure one and two assets: one risky asset (stock) and one riskless asset (bond).

The riskless asset has a price and payoff normalized to one and is in perfectly elastic supply. The per-capita supply of the risky asset is $\bar{x} + x$, where $x \sim N(0, \sigma_x^2)$. Random supply, usually attributed to the existence of noise traders or liquidity needs, prevents the risky asset price p , which is determined in equilibrium, from perfectly revealing all aggregate information.

The static model is divided into three periods. In period one, each agent chooses whether to purchase an additional piece of news about the risky asset that can be used to reduce payoff uncertainty. In period two, each agent chooses their optimal portfolio after observing the realization of both acquired news and the risky asset price. In period three, agents receive their payoffs.

2.2 Preferences

Agent i , with risk aversion ρ , makes information and portfolio decisions to maximize mean-variance utility over terminal wealth, $W_{i,3}$:

$$U_{i,1} = E_{i,1}[\rho E_{i,2}(W_{i,3}) - \frac{\rho^2}{2} \text{Var}_{i,2}(W_{i,3})]. \quad (1)$$

$E_{i,1}[\cdot]$ is an individual's expectation in period one, before he observes prices and acquired signals. $E_{i,2}[\cdot]$ and $\text{Var}_{i,2}[\cdot]$ are the expectation and variance of terminal wealth in period two, after individuals have observed signal realizations but before the investment decision has been made.

Given that terminal wealth is normally distributed, equation (1) is functionally equivalent to:

$$U_{i,1} = E_{i,1}[\log (E_{i,2}[e^{-\rho W_{i,3}}])]. \quad (2)$$

This formulation of utility, whose axiomatic foundations are first provided in Kreps and Porteus (1978), represents a preference for early resolution of uncertainty, as in Epstein and Zin (1989). That is, investors with these preferences are not adverse to the risk resolved in period two: after private signals are realized but before payoffs are known. This property allows for the benefit of information to rise in the scale of investment, a feature that is absent in the case of standard CARA preferences (Peress, 2010).

2.3 The Distribution of Initial Information

The risky asset payoff f is not known with certainty, but each agent is endowed with some private prior knowledge about it. Formally, agent i is endowed with an independent private signal: $\tilde{f}_i \sim N(f, \tilde{\tau}_i^{-1})$.

In order to isolate how the initial distribution of information affects the learning decision, I assume that the prior precision of agent i is:

$$\tilde{\tau}_i = \alpha \bar{\tau} i^{\alpha-1}, \quad (3)$$

where $\bar{\tau} = \int_0^1 \tilde{\tau}_i di$ is the average quality of initial information and $\alpha \geq 1$. Given this assumption, α can readily be interpreted as the “inequality” in the distribution of initial information. Specifically, a higher α corresponds to a greater concentration of prior precision among a smaller percentage of the population. Consistent with this interpretation, it can be shown that α is directly proportional to standard measures of inequality of a distribution used in other literatures, such as a Gini coefficient, often used to assess the concentration of income in a given population.⁴

Figure 1 plots the distribution of precision for different values of α . The dotted line corresponds to the distribution when $\alpha = 1$, where all agents are equally familiar about the risky asset’s payoff. The dashed and solid lines correspond to the distribution with higher values of α , where a smaller segment of agents hold a greater proportion of the risky asset’s prior information.

This inequality in the precision of initial information could originate from many sources. For example, a large body of theoretical research argues that the quality of corporate disclosure, which is known to differ widely across firms (Sengupta, 1998), can affect the degree of information asymmetry among shareholders (Diamond and Verrecchia, 1991; Kim and Verrecchia, 1997). Alternatively, many empirical studies have found that investors exhibit a strong preference for local firms (Coval and Moskowitz, 1999; Huberman, 2001; Grinnblatt and Keloharju, 2001), which is usually attributed to information advantages emanating from their geographic proximity (Brennen and Cao, 1997; Van Nieuwerburgh and Veldkamp, 2009;

⁴In this context, the Gini coefficient is equal to $1 - \frac{2}{\alpha+1}$. For an elementary exposition on the Gini coefficient and how it is used to measure income inequality, see Sen (1973).

Mondria and Wu, 2010). Information differences across investors could also arise due to firm-specific characteristics that affect how quickly its news diffuses across the population, such as how much media coverage the firm has previously received (Peress, 2014).

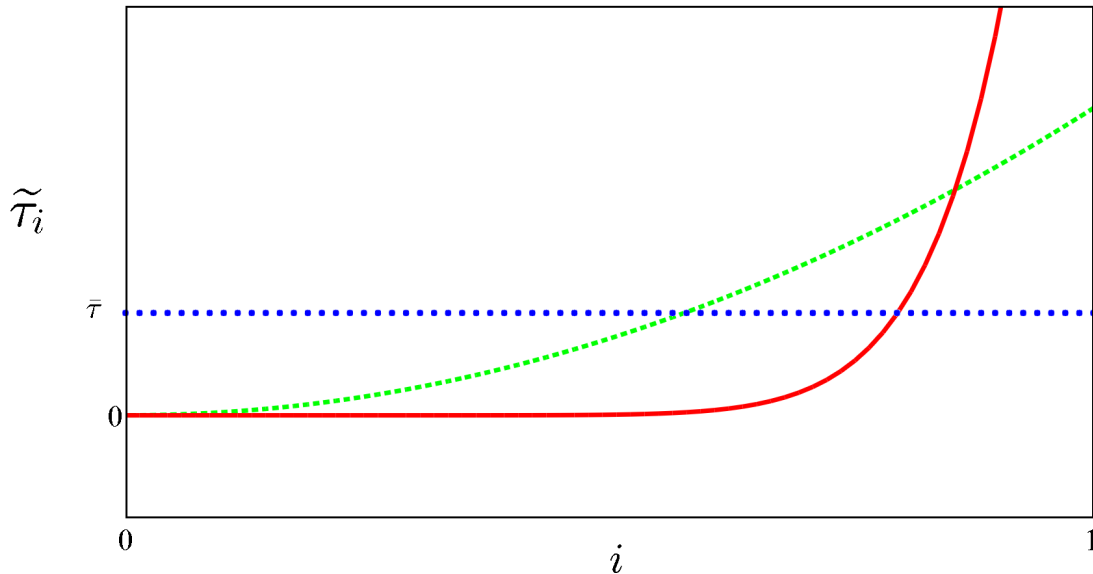


Figure 1: **The distribution of prior precision with varying levels of inequality.** This figure presents how the distribution of prior precision varies with α . The dotted line corresponds to $\alpha = 1$, where the distribution of precision is uniformly distributed across agents. The dashed curve and solid curve correspond to $\alpha = 3$ and $\alpha = 20$, respectively, whereby prior precision is more concentrated within a smaller fraction of the population. $\bar{\tau} = 1$.

2.4 News Production

In the first period, each agent decides whether to acquire an additional news signal, which can be used to reduce payoff uncertainty. Let χ be the per-capita fixed cost of discovering news about the risky asset's payoff, which can be interpreted as the cost of hiring a reporter that covers an upcoming announcement. Following Veldkamp (2006), I introduce competitive information markets by assuming that once news is discovered, a copy can be sold to others at no marginal cost.⁵ Importantly, an agent can freely enter the market for news even after

⁵High fixed costs and low marginal costs appear to be a fundamental aspect of the news industry (Hamilton, 2004).

other agents have announced the prices they will charge. In other words, the market for news is perfectly contestable. One way to ensure this contestability would be to assume that there are two sub-periods: in the first sub-period, each agent announces the price they will charge on the news item, and in the second sub-period, agents decide whether to enter the market by paying the fixed cost. This is a natural assumption for information markets, where prices are often set well before media outlets decide whether to report on a particular story.

Let d_j be an indicator variable equal to 1 if agent j discovers news and let $l_i(c_j, c_{-j}) = 1$ if agent i chooses to purchase news for price c_j , given other announced prices c_{-j} . Then, agent j chooses c_j and d_j to maximize profit:

$$\pi_j = \max_{d_j, c_j} d_j \left(c_j \int_0^1 l_i(c_j, c_{-j}) di - \chi \right), \quad (4)$$

where π_j enters agent j 's utility function through his terminal wealth, $W_{j,3}$. Pricing and entry decisions are a sub-game perfect Nash equilibrium. Since agents are strictly better off buying news at the lowest possible price, I economize on notation by denoting l_i as an indicator for whether agent i purchases news at the lowest offered price, c . Once purchased, a copy of news cannot be resold to other agents.

If agent i buys a copy of news (i.e., $l_i = 1$), the signal agent i observes is:

$$s_i = f + e_i, \quad (5)$$

where $e_i \sim N(0, \eta_i^{-1})$ is noise in interpretation. Importantly, I assume that η_i is equal to:

$$\eta_i = k\tilde{\tau}_i, \quad (6)$$

where k can be interpreted as an agent's "capacity" to process financial information. A

similar form of signal precision can be explicitly derived by the entropy-motivated learning constraints used in recent asset-pricing literature, such as Van Nieuwerburgh and Veldkamp (2009), Mondria and Wu (2010), and Kacperczyk et al. (2014).⁶ However, unlike those models, I assume that before an agent can allocate any of their processing-capacity k towards learning about an asset, they must first pay a separate cost to gain access to its news.⁷

While agents must pay for access to the news signal, all agents receive a free public signal about f from the price itself. Agents do not know the realization of this price signal before period two, but they can infer its precision in period one by knowing the learning decisions of other investors.⁸

2.5 Portfolio Selection

In period two, individuals use their prior beliefs \tilde{f}_i , their private signal s_i (if news was purchased), and price p to update posterior beliefs, which are then used to choose portfolios subject to a budget constraint. Let $q_{i,0}$ denote agent i 's demand for the riskless asset and let q_i denote agent i 's demand for the risky asset. If $W_{i,0}$ is agent i 's initial wealth, then the budget constraint is:

$$W_{i,0} = q_{i,0} + q_i p + l_i c. \tag{7}$$

⁶The assumption that investors' ability to interpret asset news is increasing in their prior precision is supported by evidence that portfolio managers who specialize in select stocks tend to earn higher returns (Ivkovic et al., 2008).

⁷Requiring agents to pay a separate cost to acquire news addresses the point raised by Sims (2006) that entropy-based learning constraints are not well-suited to address "costly investigation", which includes the production of news.

⁸By not incorporating the price signal into (6), I am implicitly assuming that no processing-capacity is required to process the information in price. Mondria (2010) shows that subjecting the price signal to entropy constraints generates multiple equilibria. To avoid this issue, one can assume that investors are endowed with enough capacity to process the price signal, as in Van Nieuwerburgh and Veldkamp (2009).

Terminal wealth $W_{i,3}$ is equal to:

$$W_{i,3} = q_{i,0} + q_i f + \pi_i. \quad (8)$$

Combining (7) and (8), agent i 's terminal wealth can be written as:

$$W_{i,3} = W_{i,0} + q_i(f - p) + \pi_i - l_i c. \quad (9)$$

2.6 Equilibrium Definition

A rational expectations equilibrium consists of agent decisions (l_i, q_i, c_i, d_i) , asset price p , news price c , and exogenous asset supply $\bar{x} + x$ such that:

- Given prices, each agent i chooses asset demand q_i and whether or not to purchase news l_i to maximize (1) subject to (6) and (9).
- Information supply entry decisions d_i and pricing strategies c_i are a sub-game perfect Nash equilibrium that maximize (4).

- Asset markets clear

$$\int_0^1 q_i di = \bar{x} + x.$$

- Rational expectations: Beliefs about payoffs, prices, and the optimal asset demands are consistent with their true distribution.

3 Solution

The model is solved through backward induction. First, each agent decides on their optimal asset demand given arbitrary signals and prices. Second, knowing how optimal

asset demand relates to every possible signal/price combination, each agent makes their information choices given the information choices of other agents.

3.1 Optimal Asset Demand

In period two, agents use the public price signal and acquired private signals to update beliefs. Let $z(p)$ denote the public price signal and let ζ denote its precision. Then with normally distributed random variables, posterior beliefs are a weighted average of the signals observed:

$$\text{Var}_{i,2}(f|\tilde{f}_i, l_i s_i, p) = \hat{\tau}_i^{-1} = \frac{1}{\tilde{\tau}_i + l_i \eta_i + \zeta}, \quad (10)$$

$$E_{i,2}(f|\tilde{f}_i, l_i s_i, p) = \hat{f}_i = \frac{\tilde{\tau}_i \tilde{f}_i + l_i \eta_i s_i + \zeta z(p)}{\tilde{\tau}_i + l_i \eta_i + \zeta}, \quad (11)$$

They make their investment decisions to maximize period two utility:

$$U_{i,2} = \rho E_{i,2}(W_{i,3}) - \frac{\rho^2}{2} \text{Var}_{i,2}(W_{i,3}). \quad (12)$$

After substituting (9) into (12), the period two problem becomes:

$$U_{i,2} = \max_{q_i} W_{i,0} + \rho q_i (\hat{f}_i - p) - \frac{\rho^2 q_i^2}{2 \hat{\tau}_i} - l_i c + \pi_i. \quad (13)$$

Taking first order conditions with respect to q_i leads to optimal share-holdings:

$$q_i = \frac{\hat{\tau}_i}{\rho} (\hat{f}_i - p). \quad (14)$$

Asset demand is increasing in both posterior precision $\hat{\tau}_i$ and the expected excess return per share $\hat{f}_i - p$. Intuitively, the more certain I am about payoffs or the more my personal evaluation of the payoff is above the opportunity cost of purchasing a share, the more risk I

will be willing to undertake.

3.2 Market Clearing Price

Aggregating optimal asset demand across agents and imposing the market-clearing condition determines the asset's equilibrium price. Following Hellwig (1980) and Admati (1985), price is a linear function of the risky asset's payoff.

Proposition 1. *Given information choices, there exists a unique linear rational expectations equilibrium. The equilibrium asset price is given by:*

$$p = f - \left(\frac{\rho \bar{x}}{\theta + \zeta} + \frac{\rho x}{\theta} \right), \quad (15)$$

where:

$$\theta = \bar{\tau} + \int_0^1 l_i \eta_i di, \quad (16)$$

$$\zeta = \left(\frac{\theta}{\sigma_x \rho} \right)^2. \quad (17)$$

Proof: See Appendix.

The term θ represents the average precision of priors and purchased signals, so that $\theta + \zeta$ is equal to the posterior precision of the “average agent”: $\int_0^1 \hat{\tau}_i di$. Substituting this term into equation (15) and taking expectations reveals that the expected excess return per share in period one is:

$$E_1(f - p) = \frac{\rho \bar{x}}{\int_0^1 \hat{\tau}_i di}. \quad (18)$$

The realization of price is only observed in period two, so this unconditional expected return

is the same across all agents, and is equivalent to the expected return that an outside observer would estimate. Note that $E_1(f - p)$ is increasing in both risk aversion and average number of outstanding shares, while it is decreasing in average posterior precision. The intuition is that, in order for the market to clear, asset prices must be lower to compensate an average investor for holding more risk. Since \bar{x} , ρ , and $\bar{\tau}$ are exogenous, equation (18) implies that a change in the distribution of initial information can only affect expected returns through the average precision of purchased signals, $\int_0^1 l_i \eta_i di$.

3.3 Optimal Information Acquisition

The Appendix shows that substituting optimal asset demand (14) into the period two objective function (13) and taking expectations over period two indirect utility yields the period one problem:

$$U_{i,1} = \max_{l_i, c_i, d_i} W_{i,0} + R(\theta) (\tilde{\tau}_i + l_i \eta_i + \zeta) - l_i c + \pi_i, \quad (19)$$

where:

$$R(\theta) = \frac{1}{2} \left(\left(\frac{\rho \sigma_x}{\theta} \right)^2 + \left(\frac{\rho \bar{x}}{\theta + \left(\frac{\theta}{\rho \sigma_x} \right)^2} \right)^2 \right). \quad (20)$$

Agents are price-takers, so they take the term $R(\theta)$ as fixed. The first step in solving an agent's period one problem is to identify how much suppliers will charge for a copy of news. The following proposition states that, given increasing returns to scale in information production, the equilibrium cost of news is declining in the number of purchasers.

Proposition 2. *In equilibrium, one agent supplies news to the entire market: $d_v^* = 1$ and*

$d_j^* = 0$ for all $j \neq v$. Furthermore, this agent will charge at average cost:

$$c^* = \frac{\chi}{\lambda^*}, \quad (21)$$

where $\lambda^* = \int_0^1 l_i^* di$.

Proof: See Appendix.

The more agents who buy a copy of news, the smaller the share of the fixed cost of discovery each agent incurs. For this reason, high demand news is less expensive to purchase. A crucial aspect of Proposition 2 for the ensuing analysis is that equation (21) is only a function of how many agents purchase a copy and not how much each agent is willing to pay conditional on having purchased. The reason is tied to the assumption of free entry: if any supplier charges above average cost, another agent can discover news, charge slightly below the incumbent, and take the entire market.⁹

Because agents are not ex-ante identical, equilibrium news demand not only depends on how many agents purchase, but also depends on which agents are doing the purchasing. Before describing how λ^* is determined, the following Lemma greatly reduces the number of permissible allocations.

Lemma 1. *In equilibrium, agent i purchases news only if all agents with a higher prior precision do the same: $l_i^* = 1$ only if $l_v^* = 1$ for all $v > i$. Therefore:*

$$\theta(\lambda^*, \alpha) = \bar{\tau} + \int_{1-\lambda^*}^1 k\bar{\tau}\alpha i^{\alpha-1}. \quad (22)$$

Proof: See Appendix.

⁹Although this result (i.e., the price of news declining in the number of purchasers) does rely on both the free entry assumption and the fixed-cost production technology, it is robust to alternative forms of competition, such as Cournot or monopolistically competitive frameworks (Veldkamp, 2006).

Two separate factors are responsible for Lemma 1. First, recall that agents who are initially more familiar with the risky asset can more accurately interpret additional asset news. A second effect, independent of any assumption placed on η_i , is that agents who are initially more familiar with the risky asset expect to hold more shares ex-ante. Since the benefit of information is rising in the expected scale of investment—one piece of news can be used to evaluate many shares—agents with a higher prior precision find adding one unit of precision more valuable. The combination of both these effects mean that, given a particular $R(\cdot)$ and c , an agents' willingness to purchase is strictly increasing in their prior precision, which in turn means that if a certain fraction of agents are purchasing, it must be the fraction who are most initially informed.

Given Proposition 2 and Lemma 1, equilibrium news production is fully characterized by λ^* .

Proposition 3. *Let $B(\lambda, \alpha)$ be the net benefit of news to the marginal purchaser:*

$$B(\lambda, \alpha) = R(\theta(\lambda, \alpha)) k\bar{\tau}\alpha(1 - \lambda)^{\alpha-1} - \frac{\chi}{\lambda}. \quad (23)$$

Then λ^ is defined by the following conditions:*

- *If $B(\lambda, \alpha) < 0$ for all $\lambda \in (0, 1]$, then $\lambda^* = 0$.*
- *If $B(1, \alpha) \geq 0$, then $\lambda^* = 1$.*
- *If $B(\lambda, \alpha) > 0$ for some $\lambda \in (0, 1)$ and $B(1, \alpha) < 0$, then:*

$$B(\lambda^*, \alpha) = 0, \quad (24)$$

$$\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*} < 0, \quad (25)$$

Proof: See Appendix.

There are three factors driving the net benefit of news to the marginal purchaser. First, the benefit of news is increasing in $R(\cdot)$, which is positively correlated with the risky asset's expected excess return per share. Also of note is that, for a given α , $R(\cdot)$ is strictly decreasing in λ . This is the canonical strategic substitutability in information acquisition result of Grossman and Stiglitz (1980): the more agents who acquire news, the lower the expected return (or equivalently, the more informative price is). An additional feature here stemming from my assumption on η_i is that this negative effect is amplified if the investors who acquire news have a high prior precision because these investors expect to trade more aggressively on the news item, which makes price more informative and lowers the required risk premium further.

Second, the benefit of news to the marginal purchaser is decreasing in the marginal purchaser's signal precision $k\bar{\tau}\alpha(1-\lambda)^{\alpha-1}$, which is itself a decreasing function of λ . The latter relation is a direct consequence of Lemma 1: the more agents who purchase news, the lower the signal precision of the agent who derives the least benefit from doing so.

Finally, the benefit curve is decreasing in the price of news, which is decreasing in λ by Proposition 2. Overall, λ has three effects on the benefit curve: two negative and one positive. When λ is arbitrarily close to 0, the positive effect dominates, so that the benefit curve generally takes the shape illustrated in Figure 2. Note that while $B(\lambda, \alpha)$ crosses 0 at two different points in Figure 2, only the higher point can be an equilibrium for supply of information. Namely, at any point where $B(\lambda, \alpha) = 0$ and $\frac{\partial B(\lambda, \alpha)}{\partial \lambda} > 0$, any agent can enter the market for news, charge slightly below average cost and make a small profit. The same cannot be said for the point where $B(\lambda, \alpha) = 0$ and $\frac{\partial B(\lambda, \alpha)}{\partial \lambda} < 0$, making it the unique equilibrium.

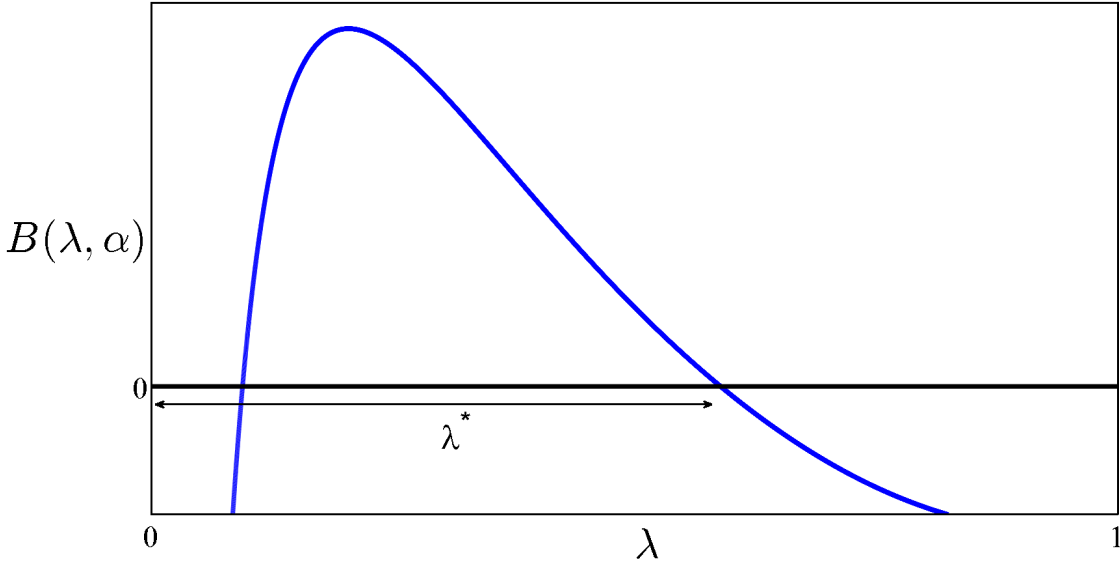


Figure 2: **Equilibrium news production.** This figure presents the benefit of news to the marginal purchaser as a function of λ . $k = 2$, $\rho = 2.5$, $\bar{\tau} = 1$, $\bar{x} = 2$, $\sigma_x^2 = 2$, $\chi = 1.1$, $\alpha = 3$.

4 Main Results

In this section, I present the main results, most of which are a direct implication of the following proposition.

Proposition 4. *Assume a positive fraction of agents purchase news in equilibrium. Then:*

$$\frac{\partial c^*}{\partial \alpha} > 0. \quad (26)$$

Proof: See Appendix.

For intuition, consider how an incremental increase in the level of inequality α affects the benefit of news to the marginal agent, holding the fraction of purchasers λ^* fixed. First, an increase in α redistributes prior precision from less informed agents to more informed agents. Due to increasing returns to learning, this redistribution increases average posterior precision for any value of λ admissible by Lemma 1, which lowers the expected return per share by

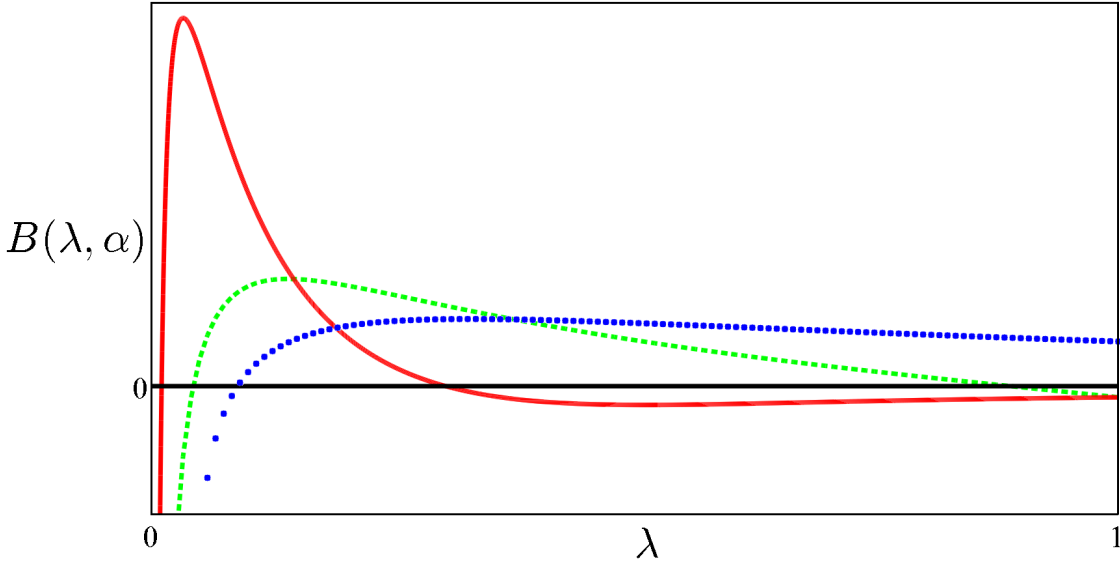


Figure 3: **The benefit of purchasing news with varying levels of inequality.** This figure presents how the benefit of news to the marginal purchaser varies with α . $k = .6$, $\rho = 2.5$, $\bar{\tau} = 1$, $\bar{x} = 2$, $\sigma_x^2 = 2$, $\chi = 1.1$, $\alpha(\text{dotted})=1$, $\alpha(\text{dashed})=2$, $\alpha(\text{solid})=8$.

equation (18). Second, an increase in α changes the marginal agent's signal precision η_i . Given an endogenous cost of news, this agent becomes less familiar with the risky asset, which reduces how aggressively he plans to trade on the story. Since the marginal agent was indifferent to purchasing before the change (by definition), and both the expected return per share and expected shareholdings are lower after the change, he is strictly better off not purchasing. This makes news more expensive for the other purchasers, who are now left with having to cover a larger share of the fixed cost of discovery. Figure 3 illustrates how the benefit curve is affected by changes to α .¹⁰ Note that higher values of α are associated with a smaller fraction of news purchasers and consequently higher news prices.

For the purposes here, Proposition 4 suggests that news markets reduce the incentive of rational investors to learn about stocks whose information is highly concentrated. This is most clearly evident by considering how the market for news alters the learning decision

¹⁰In Figure 3, when $\alpha = 1$, $\lambda^* = 1$ and no agent is indifferent between purchasing and not purchasing. However, with an infinitesimally small increase in α , $\eta_0 = 0$, so that Proposition 4 still applies in this case.

of a hypothetical investor whose prior precision is unaffected by α . Without information markets, an increase in α can only affect this hypothetical investor's willingness to acquire news via a change in the expected return per share. However, with information markets, the price of news is also increasing in α , meaning that the investor may be less inclined to purchase even if the expected return per share goes up, which gives rise to this paper's main result.

Proposition 5. *Assume a positive fraction of agents purchase news in equilibrium. Then:*

$$\frac{\partial E_1(f - p)^*}{\partial \alpha} > 0. \quad (27)$$

Proof: See Appendix.

From Proposition 4, an increase in the inequality of prior precision reduces the number of agents who expect to hold enough shares of the risky asset to warrant paying for additional asset-related news. As a result, the remaining prospective purchasers must bear a higher share of the fixed cost of discovery, which discourages them from buying and therefore increases the risky asset's expected return.

Importantly, the cross-sectional return pattern implied by Proposition 5, i.e., a higher concentration of prior information leads to higher excess returns, hinges crucially on *both* an endogenous news price arising from the information market *and* increasing returns to learning implied by my assumption on η_i . To emphasize how both features factor into the result, the next two propositions illustrate how excess returns vary with α when either feature is absent.

Proposition 6. *Assume there are no information markets and the price of news is exogenously fixed. Then there exists an $\bar{\alpha}$ such that if $\alpha > \bar{\alpha}$:*

$$\frac{\partial E_1(f - p)^*}{\partial \alpha} < 0. \quad (28)$$

Proof: See Appendix.

Proposition 7. *Assume signal precision is independent of prior precision: $\eta_i = k$. Then:*

$$\frac{\partial E_1(f - p)^*}{\partial \alpha} = 0. \quad (29)$$

Proof: See Appendix.

Proposition 6 states if the price of news is exogenously fixed and α is sufficiently high, one reaches the exact opposite conclusion: in equilibrium the excess return actually *decreases* in α . To understand why, recall that agent i 's terminal wealth from the risky asset is the return per share times the number of shares purchased, $q_i(f - p)$. With a low level of α , each agent holds a low amount of prior precision, and hence expects to hold a low number of shares. Consequently, agents are only willing to purchase news if each share expects to pay a relatively large amount. On the other hand, with a high level of α , a small fraction of agents expect to hold so many shares that they are willing to purchase news even if the payoff per share is low. Because agents are willing to keep purchasing news even at low returns, the equilibrium risk premium is smaller.

While this effect is still present when there are information markets, it is outweighed by an increasing cost of news. In other words, for high values of α and correspondingly low values of λ^* , the marginal agent still expects to hold a large stake in the risky asset, and is therefore willing to pay for information even at extremely low excess returns per share. Nevertheless, the high price of news brought on by low number of purchasers makes it prohibitively expensive to do so. Thus, the ability of agents to share the fixed cost of information production reverses how the risk premium moves with the concentration of prior precision.

The impact that an endogenous news price has on the relationship between equilibrium returns and the inequality of initial information is captured by Figure 4. In Figure 4a, the

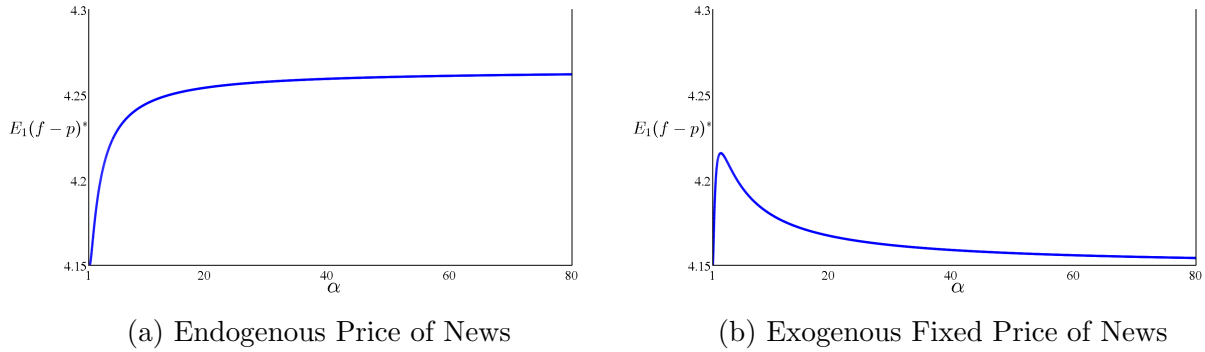


Figure 4: **Equilibrium returns with and without an endogenous price of news.** This figure presents how the equilibrium return per share $E_1(f - p)^*$ is affected by α with and without an endogenous price of news. $k = .2$, $\rho = 2.5$, $\bar{\tau} = 1$, $\bar{x} = 2$, $\sigma_x^2 = 2$, $\chi = 1.1$, $c(\text{figure a}) = \frac{\chi}{\lambda^*}$, $c(\text{figure b}) = \frac{\chi}{.5}$.

price of news is endogenous, i.e., $c = \frac{\chi}{\lambda^*}$, so that the risk premium is monotonically increasing in α by Proposition 5. In contrast, Figure 4b presents the case where the price of news is exogenously fixed at $\frac{\chi}{.5}$, so that the risk premium monotonically decreases for a high enough level of α by Proposition 6.¹¹

Similarly, Proposition 7 reveals that when there are information markets but an agent's ability to process news is independent of his priors, the equilibrium expected return per share is independent of α . In fact, it can be shown that if there were multiple risky assets, in this case an agent's learning choice is completely independent of the quality of his initial information. The reason is that, on one hand, an investor can better diversify if he chooses to learn about a less familiar asset. On the other hand, as discussed in the previous section, an investor expects to hold a higher share of his portfolio in more familiar assets. Given mean-variance utility over wealth and a news signal independent of prior precision, these two effects completely offset.¹²

¹¹It is worth noting that Figure 4b contains an increasing portion for small values of α . Recall that an increase in α amounts to a redistribution of precision from less informed to more informed agents. At a high λ^* (brought on by a low α), the marginal agent is losing prior precision after an incremental increase in α , and hence more willing to forgo purchasing. Eventually, prior precision becomes so concentrated that the marginal purchaser is actually on the receiving end of this redistribution, which gives rise to Proposition 6. While Proposition 6 holds for any parameters, the increasing portion of Figure 4b only occurs for a low a exogenous news cost.

¹²The same would not be true in the case of agents with constant absolute risk aversion (CARA). For an in-

5 Empirical Implications

The model described in this paper makes testable predictions as to what kind of firms will be inexpensive for investors to learn about and how this affects a firm's information environment and cost of capital. In this section, I review some existing empirical literature that supports the model's conclusions.

5.1 Media Coverage and Individual Investors

A key insight of this model is that assets in which many investors each expect to hold a small fraction of outstanding shares will be cheaper to learn about than assets in which few investors each expect to hold a large fraction of outstanding shares. Inasmuch as mass media outlets charge cheaper prices and individual investors hold smaller portfolios than institutional investors do, this suggests that the mass media is more likely to cover stocks with high individual ownership.

This prediction is corroborated by several recent studies. In their analysis of the no-coverage premium, Fang and Peress (2009) also measure the determinants of media coverage for 4 nationally circulated daily newspapers: *New York Times*, *USA Today*, *Wall Street Journal*, and *Washington Post*, which together account for nearly 11% of daily circulation in the United States. They find that after controlling for other firm characteristics, most notably firm size and idiosyncratic volatility, a 1% increase in the fraction of shares owned by individual investors increases the annual number of articles published about a firm by .18. Similarly, Solomon (2012) reports that a 1% increase in the fraction of shares owned by institutions decreases the number of articles about a firm announcement by between 27% to 30% in the Factiva news archive. Both papers also find that firm size has a overwhelmingly positive effect on the probability of news coverage, lending further support to the notion

depth discussion of alternative learning technologies and information preferences within a partial equilibrium setting, see Van Nieuwerburgh and Veldkamp (2010).

that the media covers firms with a large shareholder base, even if each shareholder holds a small stake in the firm.

This insight is also consistent with the growing body of evidence suggesting the mass media can influence the buying behavior of individual investors. Barber and Odean (2008) find that individual investors are much more likely to be net buyers of stocks in the news than those that are not. Engelberg et al. (2012) find that stocks receiving recommendations on the television show *Mad Money* experience large overnight price increases and subsequent reversals. Engelberg and Parsons (2011) find that local newspaper coverage increases the daily trade volume of local retail investors by anywhere between 8% to almost 50%. In the latter study, the authors exploit the exact timing of newspaper delivery relative to an observed spike in local trading, making it unlikely that media coverage and market reactions are both driven by some unobserved characteristic, such as how much a story peaks the public interest (Manela, 2014).

5.2 Asymmetric Attention and the Cross-Section of Returns

Apart from having consequences for the decisions of news suppliers, the model also makes a macro-level prediction concerning how the distribution of prior precision varies with the cost of capital. Although investors' information is not directly observable, a central tenet of the learning literature with inattentive agents is that prior precision should be highly correlated with the amount of attention paid to a stock (Van Nieuwerburgh and Veldkamp, 2009; Mondria and Wu, 2010). Therefore, one way to test the model's main result is to estimate whether stocks garnering a larger fraction of national attention from a smaller segment of the population earn higher excess returns.

Using a direct measure of investor attention first suggested by Da et al. (2011), Mondria and Wu (2012) find just that. Namely, they find that stocks with a greater degree of asymmetric attention, defined as the fraction of abnormal Google search volume for a stock

generated by local investors, earn higher returns.

This finding is difficult to reconcile with models that do not include both information markets and increasing returns to learning. First, the distribution of information in and of itself should not affect the cost of capital in markets well-approximated by perfect competition (Lambert et al., 2012). Second, as per Proposition 6, a higher concentration of prior precision can actually decrease excess returns when there are no information markets and the cost of news is exogenous. Finally, models that incorporate information suppliers, such as Veldkamp (2006) and Admati and Pfleiderer (1986), typically assume that investors are ex-ante homogenous, and therefore do not address how the distribution of prior precision affects the cost of capital. Moreover, Proposition 7 shows that a heterogeneous distribution of prior precision and an information market alone cannot generate this relationship if all investors interpret a piece of news with equal precision.

6 Conclusion

The model presented in this paper predicts that firms with a higher fraction of its private information concentrated within a smaller fraction of the population will be more expensive to learn about, which deters investors from following these firms and increases their cost of capital. Although the model is static, in a dynamic setting with multiple risky assets I conjecture that this effect can persist even while new market participants who are equally familiar with all risky assets continuously enter the market. This is because new investors are more likely to be initially exposed to stocks whose news is cheaper to purchase. This initial exposure leads them to prefer learning about the same stocks in subsequent periods. The end result is that cross-sectional variation in expected returns can persist even in the absence of any cross-sectional persistence in volatility. A dynamic framework could also explain the puzzling observation that higher media coverage is associated with lower returns, despite the

fact that media coverage appears to be a stable firm characteristic (Fang and Peress, 2009).

Another extension involves allowing investors the ability to purchase news of various qualities. Given the results documented here, a reasonable hypothesis is that the demand for news mimics the distribution of prior information: when prior information is concentrated, the market for news is represented by a small contingent of investors demanding high-quality news, whereas if prior information were uniformly distributed across the population, the market for news is represented by many investors demanding low-quality news.

Finally, this paper has an important implication for empirical efforts that use the amount of media coverage as a proxy for learning preferences: while media coverage may proxy for the information demands of many consumers, the direction of causality may indeed be reversed for a large segment of the population given increasing returns to scale in news production, especially if subscribers' demands are heterogeneous and the fixed cost of production is high. That is, it is not that media coverage reflects the learning preferences of all its subscribers, but rather subscribers' learning choices are restricted to the subset of stories covered substantially by the news.

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7 Appendix

7.1 Proof of Proposition 1

The proof is almost identical to the one found in Hellwig (1980) and Admati (1985), but with independent prior signals. First conjecture that p is of the form:

$$p = g_1 + g_2 f + g_3 x. \quad (30)$$

Next, use the market-clearing conditions to solve for g_1 , g_2 , and g_3 :

$$\bar{x} + x = \int_0^1 q_i di. \quad (31)$$

Substituting optimal asset demand (14) gives:

$$\bar{x} + x = \int_0^1 \frac{\hat{f}_i - p}{\rho \hat{\tau}_i^{-1}} di. \quad (32)$$

Substituting in equation (11) for investor i 's posterior mean \hat{f}_i gives:

$$\bar{x} + x = \int_0^1 \frac{\tilde{\tau}_i \tilde{f}_i + l_i \eta_i s_i + \zeta z(p)}{\rho \hat{\tau}_i^{-1} (\tilde{\tau}_i + l_i \eta_i + \zeta)} - \frac{p}{\rho \hat{\tau}_i^{-1}} di. \quad (33)$$

Since $\widehat{\tau}_i = \widetilde{\tau}_i + l_i \eta_i + \zeta$, this reduces to:

$$\begin{aligned} \rho(\bar{x} + x) &= \int_0^1 \widetilde{\tau}_i \widetilde{f}_i + l_i \eta_i s_i + \zeta z(p) - \frac{p}{\widetilde{\tau}_i} di \\ &= \int_0^1 \widetilde{\tau}_i \widetilde{f}_i + l_i \eta_i s_i di + \zeta z(p) - \int_0^1 p (\widetilde{\tau}_i + l_i \eta_i + \zeta) di. \end{aligned} \quad (34)$$

From (30), the public signal of f that each investor gleans from price is $\frac{p-g_1}{g_2}$. Substituting this in for $z(p)$ gives:

$$\rho(\bar{x} + x) = \int_0^1 \widetilde{\tau}_i \widetilde{f}_i + l_i \eta_i s_i di + \frac{\zeta p - \zeta g_1}{g_2} - \int_0^1 p (\widetilde{\tau}_i + l_i \eta_i + \zeta) di. \quad (35)$$

Since \widetilde{f}_i and s_i equal f in expectation:

$$\begin{aligned} \rho(\bar{x} + x) &= \int_0^1 \widetilde{\tau}_i + l_i \eta_i di f + \frac{\zeta p - \zeta g_1}{g_2} - \int_0^1 p (\widetilde{\tau}_i + l_i \eta_i + \zeta) di \\ &= \left(\bar{\tau} + \int_0^1 l_i \eta_i di \right) f - \frac{\zeta g_1}{g_2} + p \left(\frac{\zeta}{g_2} - \bar{\tau} - \int_0^1 l_i \eta_i di - \zeta \right). \end{aligned} \quad (36)$$

Let $\theta = \bar{\tau} + \int_0^1 l_i \eta_i di$, which is the average precision of the priors and private signals. Substituting θ into equation (36) and rearranging gives:

$$p \left(\frac{\zeta}{g_2} - \theta - \zeta \right) = \rho \bar{x} + \frac{\zeta g_1}{g_2} - \theta f + \rho x. \quad (37)$$

Next, solve for g_1 , g_2 , and g_3 by matching the coefficients of (30) with the coefficients of (37).

First, solving for g_2 :

$$g_2 = - \left(\frac{\zeta}{g_2} - \theta - \zeta \right)^{-1} \theta = 1. \quad (38)$$

Solving for g_3 :

$$g_3 = \left(\frac{\zeta}{g_2} - \theta - \zeta \right)^{-1} \rho = -\frac{\rho}{\theta}. \quad (39)$$

Solving for g_1 :

$$g_1 = \left(\frac{\zeta}{g_2} - \theta - \zeta \right)^{-1} \left(\rho \bar{x} + \frac{\zeta g_1}{g_2} \right) = -\frac{\rho \bar{x}}{\theta + \zeta}. \quad (40)$$

Substituting these coefficients into equation (30) yields:

$$p = f - \left(\frac{\rho \bar{x}}{\theta + \zeta} + \frac{\rho x}{\theta} \right), \quad (41)$$

which is exactly equation (15). Finally, each agent can invert this price function into a normally distributed signal about f , where the signal's precision is:

$$\zeta = \left(\frac{\theta}{\sigma_x \rho} \right)^2, \quad (42)$$

which completes the proof.

7.2 Deriving Period One Utility

The period two objective function is:

$$U_{i,2} = \rho E_{i,2}(W_{i,3}) - \frac{\rho^2}{2} \text{Var}_{i,2}(W_{i,3}), \quad (43)$$

subject to:

$$W_{i,3} = W_{i,0} + q_i(f - p) + \pi_i - cl_i. \quad (44)$$

Substituting the terminal wealth equation (44) into the period two utility function (43) gives:

$$U_{i,2} = \rho E_{i,2}(W_{i,0} + q_i(f - p) + \pi_i - cl_i) - \frac{\rho^2}{2} \text{Var}_{i,2}(W_{i,0} + q_i(f - p) + \pi_i - cl_i). \quad (45)$$

Prices are observed in period 2, $E_{i,2}(f) = \hat{f}_i$, and $\text{Var}_{i,2}(f) = \hat{\tau}_i^{-1}$. Distributing period two expectation and variance operators gives:

$$U_{i,2} = W_{i,0} + \rho q_i(\hat{f}_i - p) - \frac{\rho^2 q_i^2}{2\hat{\tau}_i} + \pi_i - cl_i. \quad (46)$$

Next, substitute in optimal asset demand (14) to find period two indirect utility and simplify:

$$\begin{aligned} U_{i,2} &= W_{i,0} + \rho \left(\frac{\hat{\tau}_i(\hat{f}_i - p)}{\rho} \right) (\hat{f}_i - p) - \frac{\rho^2}{2\hat{\tau}_i} \left(\frac{\hat{\tau}_i(\hat{f}_i - p)}{\rho} \right)^2 + \pi_i - cl_i \\ &= W_{i,0} + \frac{\hat{\tau}_i}{2} (\hat{f}_i - p)^2 + \pi_i - cl_i. \end{aligned} \quad (47)$$

Signal and price realizations are unknown to investors in period one, so expectations

must be taken over $(\widehat{f}_i - p)^2$ in order to derive period one utility:

$$E_{i,1}(U_{i,2}) = U_{i,1} = W_{i,0} + \frac{\widehat{\tau}_i}{2} E_{i,1} \left[\left(\widehat{f}_i - p \right)^2 \right] + \pi_i - cl_i. \quad (48)$$

Since $E(X^2) = Var(X) + E(X)^2$:

$$E_{i,1} \left[\left(\widehat{f}_i - p \right)^2 \right] = Var_{i,1}(\widehat{f}_i - p) + E_{i,1}(\widehat{f}_i - p)^2. \quad (49)$$

From equation (15):

$$E_{i,1}(\widehat{f}_i - p) = E_{i,1} \left(\widehat{f}_i - f - \frac{\rho \bar{x}}{\theta + \zeta} - \frac{\rho x}{\theta} \right). \quad (50)$$

Since $E_{i,1}(x) = 0$:

$$E_{i,1}(\widehat{f}_i - p) = -\frac{\rho \bar{x}}{\theta + \zeta}. \quad (51)$$

The period one expected return is the same across all agents. Next, using the Law of Total Variance:

$$\begin{aligned} Var_{i,1}(\widehat{f}_i - p) &= Var_{i,1}(f - p) - E_{i,1}(Var_{i,2}(\widehat{f}_i - p)) \\ &= Var_{i,1} \left(f - f - \frac{\rho \bar{x}}{\theta + \zeta} - \frac{\rho x}{\theta} \right) - E_{i,1}(Var_{i,2}(\widehat{f}_i - p)). \end{aligned} \quad (52)$$

The terms θ , \bar{x} , and ζ are known in period one, while p is known in period two, implying:

$$Var_{i,1}(\widehat{f}_i - p) = \frac{\rho^2 \sigma_x^2}{\theta^2} - \widehat{\tau}_i^{-1}. \quad (53)$$

Substituting equations (53) and (51) into equation (49), and substituting this equation into

the period one utility function (48) yields:

$$U_{i,1} = W_{i,0} + \frac{\widehat{\tau}_i}{2} \left(\frac{\rho^2 \sigma_x^2}{\theta^2} - \widehat{\tau}_i^{-1} + \left(\frac{\rho \bar{x}}{\theta + \zeta} \right)^2 \right) + \pi_i - cl_i. \quad (54)$$

Finally, dropping the constant term, substituting $\frac{\theta^2}{\rho^2 \sigma_x^2}$ in for ζ by equation (15), and substituting in the equation for posterior precision delivers the period one problem captured by equation (19):

$$U_{i,1} = W_{i,0} + \frac{1}{2} \left(\left(\frac{\rho \sigma_x}{\theta} \right)^2 + \left(\frac{\rho \bar{x}}{\theta + \left(\frac{\theta}{\rho \sigma_x} \right)^2} \right)^2 \right) (\widetilde{\tau}_i + l_i \eta_i + \zeta) + \pi_i - cl_i. \quad (55)$$

7.3 Proof of Proposition 2

The proof follows directly from the free entry assumption. If c^* is above average cost, another agent can enter the market for news, charge slightly below c^* , take the entire market and make a positive profit. If c^* is below average cost, any agent supplying news is making negative profit and thus strictly better off exiting the market. Finally, if c^* is priced at average cost and there is more than one supplier, then both suppliers must also be making negative profit and are strictly better off exiting.

7.4 Proof of Lemma 1

Lemma 1 is proven by contradiction. It will first be convenient to derive the (net) benefit of purchasing news to each agent, which is equal to expected utility conditional on purchasing minus expected utility conditional on not purchasing, given a particular cost c and average signal precision θ .

After substituting equation (10) into equation (19), expected utility conditional on $l_i = 1$

is:

$$U_{i,1} = W_{i,0} + R(\theta) (\tilde{\tau}_i + \eta_i + \zeta) + \pi_i - c. \quad (56)$$

The expected utility conditional on $l_i = 0$ is:

$$U_{i,1} = W_{i,0} + R(\theta) (\tilde{\tau}_i + \zeta) + \pi_i. \quad (57)$$

Taking the difference between equations (56) and (57) gives:

$$R(\theta)\eta_i - c. \quad (58)$$

Substituting in for η_i yields the net benefit of purchasing:

$$R(\theta)k\bar{\tau}\alpha i^{\alpha-1} - c. \quad (59)$$

Without loss of generality, assume that agent a purchases news in equilibrium, but agent b does not, where $b > a$. Then agent a must weakly prefer purchasing, whereas agent b must weakly prefer not purchasing:

$$R(\theta^*)k\bar{\tau}\alpha a^{\alpha-1} - c^* \geq 0, \quad (60)$$

$$R(\theta^*)k\bar{\tau}\alpha b^{\alpha-1} - c^* \leq 0. \quad (61)$$

Equations (60) and (61) imply that $a \geq b$, which is a contradiction. Therefore, an agent cannot purchase news in equilibrium unless all agents with a higher prior precision do the same. This in turn means that a given equilibrium fraction of purchasers λ^* must be the λ^*

agents with the highest prior precision, i.e., agents from $1 - \lambda^*$ to 1, so that:

$$\theta(\lambda^*, \alpha) = \bar{\tau} + \int_{1-\lambda^*}^1 \eta_i di. \quad (62)$$

Substituting in for η_i gives:

$$\theta(\lambda^*, \alpha) = \bar{\tau} + \int_{1-\lambda^*}^1 k\bar{\tau}\alpha i^{\alpha-1} di, \quad (63)$$

which completes the proof.

7.5 Proof of Proposition 3

First, given a particular $\lambda > 0$, define the (net) benefit of purchasing news to the agent who has the least to gain from doing so:

$$B(\lambda, \alpha) = R(\theta(\lambda, \alpha)) \eta_{1-\lambda} - \frac{\chi}{\lambda}, \quad (64)$$

where news is priced at average cost from Proposition 2 and the purchaser who benefits the least is agent $1 - \lambda$ from Lemma 1. Substituting in signal precision of agent $1 - \lambda$ gives:

$$B(\lambda, \alpha) = R(\theta(\lambda, \alpha)) k\bar{\tau}\alpha(1 - \lambda)^{\alpha-1} - \frac{\chi}{\lambda}. \quad (65)$$

There are three cases:

If $B(\lambda, \alpha) < 0$ for all $\lambda \in (0, 1]$: Assume $\lambda^* > 0$. Then all agents from $1 - \lambda^*$ to 1 must weakly prefer purchasing. However, the benefit of purchasing to agent $1 - \lambda$ is strictly negative for any $\lambda > 0$ by assumption. Therefore, $\lambda^* > 0$ cannot be an equilibrium. By the same logic, if $\lambda^* = 0$, no agent can enter the market for news and charge a price that makes them

positive profit. Therefore, $\lambda^* = 0$.

If $B(1, \alpha) \geq 0$: Assume $\lambda^* = 1$. Since the agent with the smallest prior precision (i.e., agent 0) weakly prefers to purchase, all other agents with a higher prior precision must as well. Furthermore, if any agent tries to enter the market for news and charge a small enough price to undermine the incumbent supplier, he must be charging less than χ and thus be making negative profit. Therefore $\lambda^* = 1$ is an equilibrium.

If $B(\lambda, \alpha) = 0$ for some $\lambda \in (0, 1)$: Assume that $\lambda^* \in (0, 1)$ and $B(\lambda^*, \alpha) = 0$. Then the marginal agent (agent $(1 - \lambda^*)$) is indifferent to purchasing by assumption, and all agents with high prior precisions strictly prefer doing so. Therefore, λ^* is an equilibrium for news demand. However, consider the case where $\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*} > 0$. In this case, an agent can enter the market for news, charge $\frac{\chi}{\lambda^* + e}$ for an arbitrarily small $e > 0$ and get at least $\lambda^* + e$ to purchase, making a positive profit. Therefore, only a point where $\frac{\partial B(\lambda, \alpha)}{\partial \lambda} \leq 0$ can be an interior equilibrium for both the supply and demand for news, which completes the proof.

7.6 Proof of Proposition 4

Assume that the equilibrium fraction of purchasers is positive ($\lambda^* > 0$). First, note that $\eta_0 = 0$ when $\alpha > 1$. Therefore, an equilibrium where all agents purchase ($\lambda^* = 1$) can only occur when $\alpha = 1$, which in turn implies that $\lambda^* < 1$ for any incremental increase in α . Next, note that the cost of news c^* is strictly decreasing in the equilibrium fraction of purchasers λ^* by Proposition 2. Given these two statements, proving Proposition 4 amounts to showing that:

$$\frac{\partial \lambda^*}{\partial \alpha} < 0, \tag{66}$$

when $\lambda^* \in (0, 1)$. Observe that:

$$\frac{d\theta(\lambda^*, \alpha)}{d\alpha} = \frac{\partial\theta(\lambda^*, \alpha)}{\partial\lambda^*} \frac{\partial\lambda^*}{\partial\alpha} + \frac{\partial\theta(\lambda^*, \alpha)}{\partial\alpha}, \quad (67)$$

which implies:

$$\frac{\partial\lambda^*}{\partial\alpha} = \frac{\frac{d\theta(\lambda^*, \alpha)}{d\alpha} - \frac{\partial\theta(\lambda^*, \alpha)}{\partial\alpha}}{\frac{\partial\theta(\lambda^*, \alpha)}{\partial\lambda^*}}. \quad (68)$$

Recall that $\theta(\lambda^*, \alpha) = \bar{\tau} + \int_{1-\lambda^*}^1 k\bar{\tau}\alpha i^{\alpha-1} di$, so by the Leibnitz rule:

$$\frac{\partial\theta(\lambda^*, \alpha)}{\partial\lambda^*} = \eta_{1-\lambda^*} > 0, \quad \frac{\partial\theta(\lambda^*, \alpha)}{\partial\alpha} = -k\bar{\tau}(1-\lambda^*)^\alpha \log(1-\lambda^*) > 0. \quad (69)$$

Therefore, equation (68) must be strictly negative if $\frac{d\theta(\lambda^*, \alpha)}{d\alpha} < 0$. From Proposition 3, if $\lambda^* \in (0, 1)$:

$$B(\lambda^*, \alpha) = R(\theta(\lambda, \alpha)) \eta_{1-\lambda^*} - \frac{\chi}{\lambda^*} = 0. \quad (70)$$

Taking the total derivative of both sides yields:

$$\frac{\partial B(\lambda^*, \alpha)}{\partial\lambda^*} \frac{\partial\lambda^*}{\partial\alpha} + \frac{\partial B(\lambda^*, \alpha)}{\partial\alpha} = 0. \quad (71)$$

which implies:

$$\frac{\partial\lambda^*}{\partial\alpha} = -\frac{\frac{\partial B(\lambda^*, \alpha)}{\partial\alpha}}{\frac{\partial B(\lambda^*, \alpha)}{\partial\lambda^*}}. \quad (72)$$

Next, note that:

$$\frac{\partial B(\lambda^*, \alpha)}{\partial \alpha} = \frac{\partial R(\theta(\lambda^*, \alpha))}{\partial \theta(\lambda^*, \alpha)} \frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*} \eta_{1-\lambda^*} + R(\theta(\lambda^*, \alpha)) \frac{\partial \eta_{1-\lambda^*}}{\partial \alpha}, \quad (73)$$

$$\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*} = \frac{\partial R(\theta(\lambda^*, \lambda^*))}{\partial \theta(\lambda^*, \alpha)} \frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*} \eta_{1-\lambda^*} + R(\theta(\lambda^*, \alpha)) \frac{\partial \eta_{1-\lambda^*}}{\partial \lambda^*} + \frac{\chi}{\lambda^{*2}}. \quad (74)$$

Substituting equations (72), (73), and (74) into equation (67) and canceling terms gives:

$$\frac{d\theta(\lambda^*, \alpha)}{d\alpha} = \frac{1}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-\frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*} \left(R(\theta(\lambda^*, \alpha)) \frac{\partial \eta_{1-\lambda^*}}{\partial \alpha} \right) + \frac{\partial \theta(\lambda^*, \alpha)}{\partial \alpha} \left(R(\theta(\lambda^*, \alpha)) \frac{\partial \eta_{1-\lambda^*}}{\partial \lambda^*} + \frac{\chi}{\lambda^{*2}} \right) \right]. \quad (75)$$

Since $R(\theta(\lambda, \alpha)) \eta_{1-\lambda^*} = \frac{\chi}{\lambda^*}$ in equilibrium:

$$\begin{aligned} \frac{d\theta(\lambda^*, \alpha)}{d\alpha} &= \frac{1}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-\frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*} \left(\frac{\chi}{\lambda^*} \frac{\partial \eta_{1-\lambda^*}}{\partial \alpha} \right) + \frac{\partial \theta(\lambda^*, \alpha)}{\partial \alpha} \left(\frac{\chi}{\lambda^*} \frac{\partial \eta_{1-\lambda^*}}{\partial \lambda^*} + \frac{\chi}{\lambda^{*2}} \right) \right] \\ &= \frac{\frac{\chi}{\lambda^*}}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-\frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*} \left(\frac{\frac{\partial \eta_{1-\lambda^*}}{\partial \alpha}}{\eta_{1-\lambda^*}} \right) + \frac{\partial \theta(\lambda^*, \alpha)}{\partial \alpha} \left(\frac{\frac{\partial \eta_{1-\lambda^*}}{\partial \lambda^*}}{\eta_{1-\lambda^*}} + \frac{\chi}{\lambda^*} \right) \right]. \end{aligned} \quad (76)$$

Next:

$$\begin{aligned} \left(\frac{\frac{\partial \eta_{1-\lambda^*}}{\partial \lambda^*}}{\eta_{1-\lambda^*}} + \frac{\chi}{\lambda^{*2}} \right) &= -\frac{(\alpha - 1)\bar{\tau}\alpha(1 - \lambda^*)^{\alpha-2}}{\bar{\tau}\alpha(1 - \lambda^*)^{\alpha-1}} + \frac{1}{\lambda^*} \\ &= \frac{1 - \alpha\lambda^*}{\lambda^*(1 - \lambda^*)}. \end{aligned} \quad (77)$$

Substituting the equation for $\frac{\partial \theta(\lambda^*, \alpha)}{\partial \lambda^*}$ and $\frac{\partial \theta(\lambda^*, \alpha)}{\partial \alpha}$ along with equation (77) into (76) gives:

$$\frac{d\theta(\lambda^*, \alpha)}{d\alpha} = \frac{\frac{\chi}{\lambda^*}}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-\eta_{1-\lambda^*} \left(\frac{\frac{\partial \eta_{1-\lambda^*}}{\partial \alpha}}{\eta_{1-\lambda^*}} \right) - k\bar{\tau}(1 - \lambda^*)^\alpha \log(1 - \lambda^*) \left(\frac{1 - \alpha\lambda^*}{\lambda^*(1 - \lambda^*)} \right) \right]. \quad (78)$$

Since $\frac{\partial \eta_{1-\lambda^*}}{\partial \alpha} = k\bar{\tau}(1-\lambda^*)^{\alpha-1}(1+\alpha \log(1-\lambda^*))$:

$$\begin{aligned} \frac{d\theta(\lambda^*, \alpha)}{d\alpha} &= \frac{\frac{\chi}{\lambda^*}}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-k\bar{\tau}(1-\lambda^*)^{\alpha-1}(1+\alpha \log(1-\lambda^*)) - k\bar{\tau}(1-\lambda^*)^\alpha \log(1-\lambda^*) \left(\frac{1-\alpha\lambda^*}{\lambda^*(1-\lambda^*)} \right) \right] \\ &= \frac{-\lambda^* k\bar{\tau}(1-\lambda^*)^{\alpha-1} \frac{\chi}{\lambda^*}}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} [\lambda^* + \log(1-\lambda^*)]. \end{aligned} \quad (79)$$

The term $\lambda^* + \log(1-\lambda^*)$ is strictly negative for all $\lambda^* \in (0, 1)$, and $\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}$ cannot be positive for any interior solution by Proposition 3. Therefore, $\frac{d\theta(\lambda^*, \alpha)}{d\alpha}$ is strictly negative, which implies $\frac{\partial \lambda^*}{\partial \alpha} < 0$ when $\lambda^* > 0$ by equation (68), thus completing the proof.

7.7 Proof of Proposition 5

Assume that the equilibrium fraction of purchasers is positive ($\lambda^* > 0$). From equation (18), the period one excess return per share $E_1(f-p)$ is:

$$E_1(f-p) = \frac{\rho \bar{x}}{\int_0^1 \widehat{\tau}_i di}, \quad (80)$$

where $\int_0^1 \widehat{\tau}_i di$ is strictly increasing in $\theta(\lambda^*, \alpha)$. Therefore, it is sufficient to show that:

$$\frac{d\theta(\lambda^*, \alpha)}{d\alpha} < 0, \quad (81)$$

when $\lambda^* > 0$. But this follows directly from equation (79). Therefore the equilibrium risk premium $E_1(f-p)^*$ is strictly increasing in α , which completes the proof.

7.8 Proof of Proposition 6

If the cost of news c is exogenously fixed, the net benefit of purchasing to the marginal agent is:

$$B(\lambda, \alpha) = R(\theta(\lambda^*, \alpha)) k\bar{\tau}\alpha(1 - \lambda^*)^{\alpha-1} - c, \quad (82)$$

which is now strictly decreasing in λ because the endogenous cost is absent. Since the period one excess return per share $E_1(f - p)^*$ is strictly decreasing in θ , it is sufficient to show that there exists a cutoff value $\bar{\alpha}$ such that:

$$\frac{d\theta(\lambda^*, \alpha)}{d\alpha} > 0, \quad (83)$$

for all $\alpha > \bar{\alpha}$. First, note that for a sufficiently high α , equation (82) is strictly positive when $\lambda = 0$, which in turn implies that $\lambda^* > 0$. Therefore, for a sufficiently high α , we can apply the characterization of an interior solution found in Proposition 3 and repeat the same steps as the proof of Proposition 4, which yields:

$$\begin{aligned} \frac{d\theta(\lambda^*, \alpha)}{d\alpha} &= \frac{c}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} \left[-k\eta_{1-\lambda^*} \left(\frac{\frac{\partial \eta_{1-\lambda^*}}{\partial \alpha}}{\eta_{1-\lambda^*}} \right) + k\bar{\tau}(1 - \lambda^*)^\alpha \log(1 - \lambda^*) \left(\frac{\alpha - 1}{1 - \lambda^*} \right) \right] \\ &= \frac{-k\bar{\tau}(1 - \lambda^*)^{\alpha-1}c}{\frac{\partial B(\lambda^*, \alpha)}{\partial \lambda^*}} [1 + \log(1 - \lambda^*)]. \end{aligned} \quad (84)$$

The term $1 + \log(1 - \lambda^*)$ is strictly positive for all λ^* less than 0.632. Since $\lambda^* \in (0, 1)$ for a sufficiently high α by the logic above, and λ^* is strictly decreasing for a sufficiently large increase in α by Proposition 4, $1 + (1 - \lambda^*)$ must be strictly positive above some cutoff α , which makes equation (84) strictly positive as well, thus completing the proof.

7.9 Proof of Proposition 7

Assume that the precision of news is independent of prior precision: $\eta_i = k$. In this case, the average precision of priors and purchased signals is not influenced by which agents are purchasing, so that:

$$\theta = \bar{\tau} + \int_0^{\lambda^*} k di, \quad (85)$$

which is independent of α . Since both θ and η_i are independent of α , a change in α cannot affect the equilibrium fraction of buyers, which completes the proof.

Mainstream Banking amongst Hispanic, Black and Asian Populations

By Rebecca Gonzalez

University of North Carolina at Pembroke

Abstract

Given the large number of unbanked and underbanked households throughout the United States, this study analyzes factors that might influence individuals to use alternate mainstream banking options. The FDIC has attempted to understand resistance to mainstream banking over the last few years. It has conducted the National Survey of Unbanked and Underbanked Households since 2009. Little research has attempted to garner information on personal financial circumstances and ability and willingness to use checking and savings accounts. Our findings from the FDIC's 2013 Survey of Unbanked and Underbanked indicate that 20.5% of black households, 17.9% of Hispanic households, 3.6% of White households, and 2.2% of Asian households are unbanked. To be unbanked means that individuals do not have a checking or savings account. Additionally, we find that 33.1% of Black households, 28.5% of Hispanic households, 17.9% of Asian households and 15.9% of White households are underbanked. To be underbanked is to have a bank account while still using alternate financial services (check-cashing services, payday loans, tax refund anticipation loans, rent-to-own, money orders, pawn shops, etc.). Using a preliminary logistic regression analysis to help predict the probability of not having a checking/savings account and/or using fringe financial services, we find that income, education and race/ethnicity are significant in determining the probability of being unbanked/underbanked for Hispanic and Black households. Our next step is to try to find out why the other large minority group (Asian) does not encounter the same financial issues as Hispanics and Blacks.

USING BUSINESS MEMOS TO INTRODUCE AUDIENCE CONSIDERATIONS FOR A DISCUSSION OF A PRODUCTIVITY PROBLEM

Julie Ann Stuart Williams, Department of Management/MIS, University of West Florida, 11000 University Parkway, Pensacola, FL 32514, 850-474-2283, jawilliams@uwf.edu
Kristine Gallamore, Department of Management/MIS, University of West Florida, 11000 University Parkway, Pensacola, FL 32514, klg30@students.uwf.edu

ABSTRACT

This paper presents a series of business memos for a productivity problem to introduce audience considerations in an introductory undergraduate operations management course. By asking the students to assume the role of an operations manager, they are led through a series of class discussions and memos to discover who in an organization may be involved in writing memos, evaluating performance, identifying problems, and developing solutions.

INTRODUCTION

An operations manager provides leadership for the activities required to create goods and services in an organization. Operations managers support quality goals and problem solving for teams of co-workers within their organization. To provide effective leadership, an operations manager must be able to identify who in their organization needs to be involved in tracking metrics, in order to gage the performance of an organization and to develop solutions to operations problems. The study of operations management for undergraduate juniors and seniors provides an overview of mathematical tools and concepts that help an operations manager be a more informed decision maker.

Traditionally, operations management courses have focused on the mathematical tools to calculate performance metrics such as productivity, forecasting error, product contribution, statistical process control limits, expected output, and inventory turnover. What is missing from the focus on calculating performance metrics is the ability to see the context of the performance metrics for larger organizations and identify who in an organization needs the performance information to identify problems and develop solutions. Sharing a series of business memos is an approach that illustrates who in an organization communicates with whom about performance metrics (Kogen 1983). Furthermore, Stearns, Ronald, Greenlee, and Crespy (2003, p. 216) point out that “it is not enough to know one’s subject or be able to relate abstractions to specific cases; one must also know how, when, where, and why to communicate that knowledge and to whom

one is communicating.” Kuh (2008) identifies writing across the curriculum in areas such as quantitative reasoning as a high impact educational practice. Using the high impact practice of written communication in a quantitative business course can provide an opportunity for students to learn about audience considerations while they are learning about performance metrics.

This paper presents a series of business memos to engage operations management students in identifying the audience for specific performance metrics and problem solving. The series of business memos presented focuses on the productivity performance metric that is often the first metric introduced in an operations management class.

A SERIES OF BUSINESS MEMOS TO GUIDE A PRODUCTIVITY DISCUSSION

The business memos provide examples of professional communication among different personnel in an organization. The series of business memos presented focus on the productivity metric introduced in an undergraduate operations management class. The productivity metric is the ratio of outputs to inputs. Students assume the role of an operations manager as they explore how a fictitious coffee shop chain, Calm Coffee, might improve its productivity.

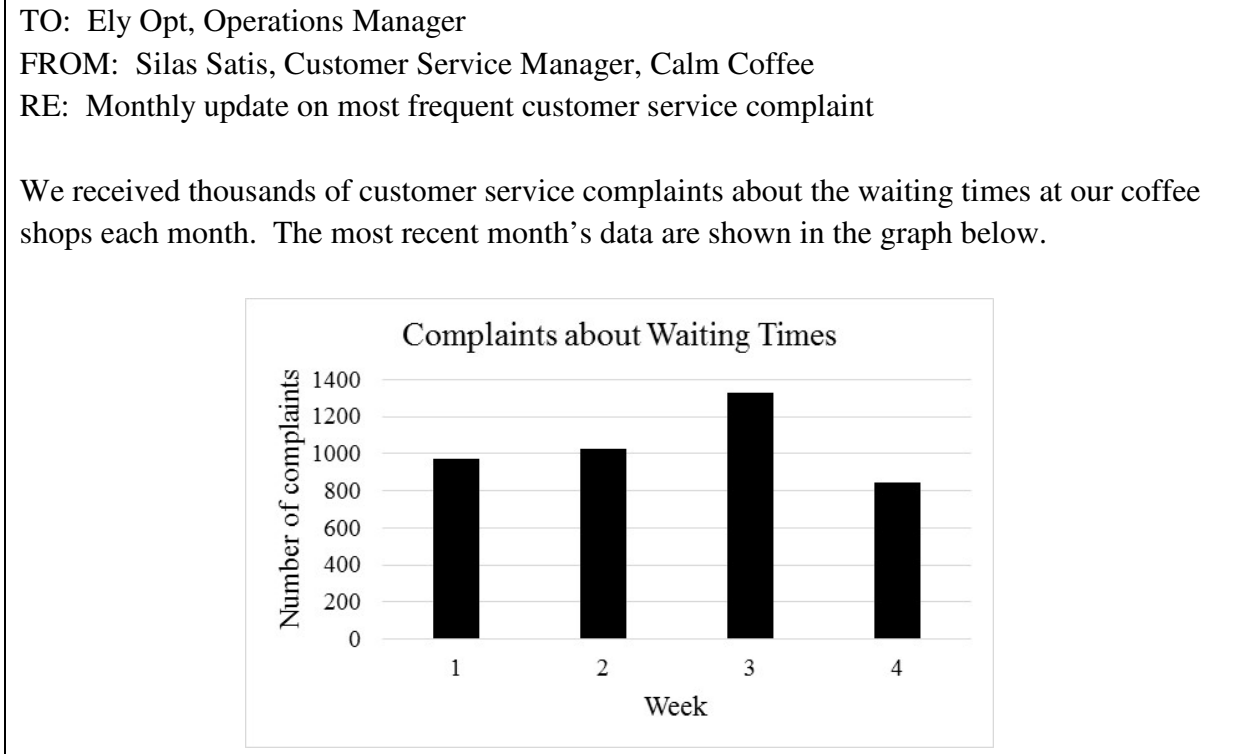
First, students are asked to think about who in an organization tracks the outcome of the organization’s performance. Students might identify customer service, marketing, quality control, logistics, and other internal departments in an organization. For additional practice students could be asked to draft a memo to the internal department they select. Next, students are asked to review a memo in which the operations manager has selected customer service for the data gathering stage of operations management.

Figure 1. Memo 1 to gather data.

<p>TO: Silas Satis, Customer Service Manager, Calm Coffee FROM: Ely Opt, Operations Manager, Calm Coffee RE: Most frequent customer complaint data request</p> <p>I am seeking ways to improve our productivity. Since you collect data on customer complaints, would you forward data to me on the most frequent complaint you received last month?</p>
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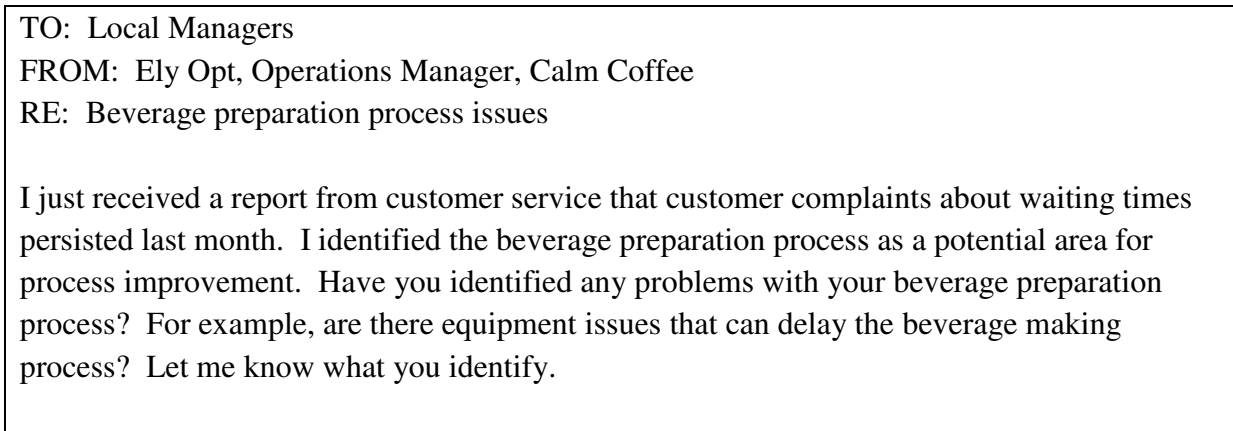
In Figure 1, the operations manager introduces the idea that productivity may be impacted by customer service problems. The operations manager seeks data from customer service to determine if the customers might provide clues about possible areas to reduce inputs which will help the operations manager ultimately improve the productivity ratio. Next, the students are asked to review the response memo shown in Figure 2 from the customer service manager.

Figure 2. Memo 2 with customer service data.



Then students are asked to think about what might be causing the long customer wait times referenced in Figure 2. Students might identify times of day with the highest demand, recipe complexity, repetitive motions, multiple types of equipment to use, equipment problems, raw materials quality, staffing levels, or the payment process. Next, students are asked to review a memo in Figure 3 in which the operations manager focuses the data gathering phase of operations management.

Figure 3. Memo 3 to focus data gathering



After reviewing memo 3, it is pointed out that the local shop managers and their personnel are critical to contact for information about the daily operations and challenges. Students could be asked to reflect on their own work experiences in which equipment was not optimal and delayed their work. Next, students are asked to review Memo 4 in which a local manager relates equipment issues.

Figure 4. Memo 4 with local manager feedback on process complaints

TO: Ely Opt, Operations Manager, Calm Coffee

FROM: Joe Local, Manager of the Calm Coffee on Star Street in Star City

RE: Beverage preparation process issues

I have several workers complaining about the number of times they have to dig and scoop ice to make our cold beverages. I also noticed that our baristas spend time grinding the coffee beans and then spend time transferring them to the brewing machines and then spend time waiting for brewing to be completed.

In Figure 4, students learn from a local manager the equipment issues they are experiencing which provide important clues for process improvements that could ultimately reduce inputs. Students are asked to identify equipment changes that could reduce beverage preparation time. In Figure 5, students are given an example of the conclusions an operations manager might develop.

Figure 5. Memo 5 with ideas to reduce beverage preparation time

TO: Local Shop Managers, Calm Coffee

FROM: Ely Opt, Operations Manager, Calm Coffee

RE: Equipment to improve beverage preparation

Thank you for providing insights into issues with the beverage preparation process. We completed our initial study of the beverage preparation process and service times at Calm Coffee. We plan to make the following equipment changes:

- 1) We will work with the beverage scoop supplier to design a larger scoop that can provide enough ice for all of our different cold beverage sizes, in order to reduce the number of times the barista has to bend and dig to scoop the ice. I estimate that this can save an average of 14 seconds of the current 60 second preparation time.
- 2) We can reduce the number of barista motions with new espresso machines that grind coffee beans and brew. Installing these could save over 12 seconds per beverage.

Your insights were critical to identify ways to reduce our beverage preparation time so we can ultimately improve our customer service times and our productivity.

A paragraph in the operations management textbook (Heizer and Render, 2014, p. 14) summarizes equipment changes at the current Starbucks chain. This exercise extends that textbook paragraph description of the actual Starbucks example of productivity improvement solutions by providing fictitious Calm Coffee chain examples of business communications to identify areas of improvement, and gather and evaluate data prior to developing the final solutions. Through a series of business memos, students gain insights into the different personnel who can be involved in gathering insights and data.

DISCUSSION AND CONCLUSION

The series of memos presented in this paper were developed for a class exercise that provides for both personal student reflection and class discussion. Thus, every student has the opportunity to write responses regardless of whether he or she has a chance to verbalize them with the class.

In conclusion, the high impact practice to integrate professional communication into class discussions about performance metrics in operations management helps students not only learn about the components of a particular metric such as productivity but also who is involved in using that metric and improving company performance for that metric. Introducing how to measure business performance and improve it through role playing a business scenario with professional writing can help students become more engaged in learning about the use of performance metrics in an industry. As students read through the business memos presented here, they assumed the role of an operations manager seeking to improve productivity. In this role, students had the opportunity to identify the audiences for professional communication and their roles. Students can gain richer insights into how to identify issues, develop a team approach to gathering data and insights, and develop solutions that can lead to performance improvements.

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WEAVING THE THREAD OF ENTREPRENEURSHIP THROUGH A CORE BUSINESS CURRICULUM

Nicholas W. Twigg ntwigg@coastal.edu 843-349-2241

Leann Mischel lmischel@coastal.edu 843-349-2023

Janice A. Black janblack@coastal.edu 843-349-5012

Department of Management and Decision Sciences
E. Craig Wall Sr. College of Business Administration
Coastal Carolina University

Abstract

Without student cooperation and participation, learning does not occur. A consistent challenge in university education is motivating the traditional aged student to take on personal responsibility for learning in courses that are not considered to be “easy.” This is particularly the case in such courses that are found in the freshman and sophomore years – the time during which students are still getting acclimated to the college life. There is extra pressure on departmental outcomes from the university which relies to a certain extent upon its reputation. The university’s reputation is based in part on the retention of students and the four to six year graduation rate. One way to motivate students to retain knowledge and stay at a particular university is to provide learning contexts which meet their preferences. The paper reviews the qualities and characteristics of millennial students. An overview of their attitudes about different types of pedagogy, as well as, some unintended consequences of those pedagogies is presented. Areas of interest to such students are reviewed and topics that could be used as attractive themes are derived. With the popularity of “The Shark Tank”, entrepreneurship is such theme. The set of courses in the freshman and sophomore year that are traditionally considered obstacles for students are identified. One such course, the decision analysis course, is chosen for closer examination. Decision Analysis concepts include: spreadsheet modeling, optimization modeling, network models, project scheduling, PERT/CPM, inventory models, forecasting, decision analysis, regression and forecasting models, and, finally, creativity and decision making. The Entrepreneurial cycle Includes: determining an opportunity, testing an opportunity, discovering the customer, designing a product solution, testing the product solution in the target market, Deciding whether or not to proceed, validating the customer via focus groups, validating the customer via pilot sales, position the product and company, forecasting early growth, making the final go-no go decision. A mapping of these two sets of concepts and how decision analysis might be taught within a theme of a traditional business start-up is provided. The development of a sample learning unit complete with student learning objectives, instructor scripts, exercises, and answer keys is shown. Specifically, we argue that a unit that includes entrepreneurial activities is best tied to the course. The demonstration will include how the unit meets the need of the decision analysis course. Second, it will show how it supports future analysis needed by entrepreneurs as they pursue an idea. Finally, it will show how it meets the motivational and desired learning pedagogies of the millennial student. We draw the conclusion that an entrepreneurial thread can easily be woven into a decision analysis course as well as others and that the entrepreneurial learning techniques are beneficial to all students.

ACTIVE LEARNING WITH BUSINESS MEMOS TO LEAD STUDENTS TO DISCOVER HOW TO MODEL A THIRD DECISION

Julie Ann Stuart Williams, Department of Management/MIS, University of West Florida, 11000 University Parkway, Pensacola, FL 32514, 850-474-2283, jawilliams@uwf.edu
Randall Reid, Department of Management/MIS, University of West Florida, 11000 University Parkway, Pensacola, FL 32514, 850-474-2701, rreid1@uwf.edu
Kristine Gallamore, Department of Management/MIS, University of West Florida, 11000 University Parkway, Pensacola, FL 32514, klg30@students.uwf.edu

ABSTRACT

In this paper, we describe an active learning exercise for a business scenario with associated business writing to introduce a third business decision in an introductory undergraduate management science course. By asking the students to assume the role of a junior analyst, they are led through a series of class discussions to discover how to review business communications to identify the third decision, identify the additional data, and then formulate the associated mathematical model with three decision variables.

INTRODUCTION

In an undergraduate introduction to management science class, students are first introduced to modeling two decision word problems and solving the problems using the graphical solution method. In an examination of four introductory management science textbooks, we identified how various authors introduced a third decision variable to a linear programming problem. All four textbooks opened with an introductory chapter on management science followed by a chapter demonstrating the graphical solution technique for only two decision variables. The approach to introduce a third decision variable existed on a continuum. At one end of the continuum, Taylor (2013) includes three or more decision variable problems at the end of chapter 3 without discussion or examples in the third chapter. Hillier and Hillier (2015) and Ragsdale (2015) introduce a new problem with three decision variables in the text of their third chapters. However, there were no specific discussions of transitioning from modeling with two variables versus three variables in these three textbooks. On the other end of the continuum, Anderson, Sweeney, Williams, Camm, Cochran, Fry, and Ohlmann (2016) introduced a third variable in their third chapter on sensitivity analysis by extending a two decision variable problem that had been solved using the graphical technique. They introduced the additional decision variable via a paragraph that gave the objective function coefficient costs and constraint

coefficient manufacturing times for each of the resources used. The revised formulation with the third decision variable incorporated into the objective function and four manufacturing time constraints were then presented and used as the basis for sensitivity analysis.

In this paper, we combine the Anderson, et al (2016) extension approach with the Riddle (2010) active learning approach. Riddle (2010) uses an active learning class exercise to encourage students to discover how to build a two-variable linear programming model as well as discover feasible solutions. Furthermore, we integrate writing about quantitative business decisions. Kuh (2008) identifies writing across the curriculum in areas such as quantitative reasoning as a high impact educational practice. In this paper, we describe an imbedded business scenario with associated business writing to introduce a third business decision in an active learning exercise. By asking the students to assume the role of a junior analyst, they perform an initial two decision analysis and prepare business memos with their recommendations. Then they are led through a series of class discussions to discover how to review follow-up business communications to identify the third decision, identify the additional data, and then formulate the associated mathematical model with three decision variables.

EMBEDDED HIGH IMPACT MEMO DISCUSSION METHOD

In Figure 1, a series of four business memos from four different managers are used to define the first homework assignment for a two decision production planning problem. In the assignment, students take on the role of a junior business analyst tasked with developing a production plan for regular and deluxe eco-towels. The students are required to use the information in the memos from the General, Procurement, Operations, and Marketing managers to write a business memo, and to formulate a linear programming model as shown in Figure 2. Note that Figure 2 omits the graphical solution procedure since this paper is focused on extending the formulation. After students turn in the assignment to build the two decision model, solve it, and write a memo describing the problem and their recommended production plan, the business scenario for the homework problem is used for additional class periods to introduce new concepts.

Figure 1. Original homework assignment composed of 4 memos

MEMO

TO: Junior business analyst

FROM: Ed Green, Manager; Eco-Towels

RE: Production planning for sea turtle eco-towels for the coastal market

How many regular sea turtle eco-towels and deluxe sea turtle eco-towels for the coastal market should we produce next week in order to maximize profit? Please confer with the procurement, operations, and marketing managers for appropriate data and constraints.

MEMO

TO: Junior business analyst

FROM: Bill Spender, Procurement Manager

RE: Procurement information for sea turtle eco-towels for the coastal market

Each regular sea turtle eco-towel requires 1 meter of regular fabric which can be procured at \$6/meter. Each deluxe sea turtle eco-towel requires 1.2 meters of deluxe fabric which can be procured at \$8/meter. We can procure up to 350 meters of regular fabric. To deplete the current deluxe fabric in stock, use exactly 360 meters of deluxe fabric for the production plan.

MEMO

TO: Junior business analyst

FROM: Ollie Efficiency, Operations Manager

RE: Operations data for sea turtle eco-towels for the coastal market

Each regular sea turtle eco-towel requires 4 minutes of assembly time while each deluxe sea turtle eco-towel requires 5 minutes of assembly time. There are 40 hours of assembly time available. Assembly labor costs \$12/hour.

MEMO

TO: Junior business analyst

FROM: Melanie Show, Marketing Manager

RE: Marketing insights for sea turtle eco-towels for the coastal market

Produce the regular towels with the regular fabric and produce the deluxe towels with the deluxe fabric. The regular sea turtle eco-towel will sell for \$10.80 while the deluxe sea turtle eco-towel will sell for \$13.60. We anticipate strong demand for both types of sea turtle eco-towels.

Figure 2. Original Response Memo and Linear Programming Model for Homework Assignment in Figure 1

MEMO	
TO: Ed Green, Manager;	
FROM: Junior business analyst	
CC: Bill Spender, Procurement Manager Ollie Efficiency, Operations Manager Melanie Show, Marketing Manager	
RE: Production planning for sea turtle eco-towels for the coastal market	
<p>In response to your request to determine the number of regular and deluxe sea turtle eco-towels to produce and sell next week in order to maximize profit, I gathered information from procurement, operations, and marketing. Procurement provided the fabric costs per towel and the regular and deluxe fabric available and requested that all of the deluxe fabric be utilized. Operations provided the assembly time per towel, the assembly time available, and the cost of assembly labor. I also assumed no backorders. Assuming that each towel produced is sold, I recommend the following product mix:</p>	
<p>225 Regular sea turtle eco-towels 300 Deluxe sea turtle eco-towels</p>	
<p>Producing and selling this mix of regular and deluxe towels will generate \$1800 in profit. I based my recommendation on a linear programming model that is defined in attachment 1. I solved my model using the graphical solution method as well as by using the solver in the Excel software. If you have any questions, please contact me.</p>	
<p>Attachment 1: Production Planning Model for Eco-Towels</p>	
Legend:	<p>X1 = number of regular sea turtle eco-towels produced and sold X2 = number of deluxe sea turtle eco-towels produced and sold</p>
Objective Function:	<p>MAX $4X_1 + 3X_2$ Maximize profit</p>
Constraints:	
1) $4X_1 + 5X_2 \leq 2400$	Assembly time available (minutes)
2) $1X_1 \leq 350$	Regular fabric available (meters)
3) $1.2X_2 = 360$	Deluxe fabric depletion requirement (meters)
4) $1X_1, 1X_2 \geq 0$	Non-negativity constraint

For example, Figure 3 shows a handout that asks the students to continue their role play as a junior business analyst by reading a follow-up memo. The follow-up memo from the General Manager describes a new super eco-towel design that must be considered. Students are also given a series of questions to answer as a class as shown in Figure 4. Students are asked to identify how the original problem has changed with the introduction of the new design. Then they are asked to identify what additional information they will need from the Procurement, Operations, and Marketing managers to extend their production planning model to include the new super eco-towel design.

Figure 3. Class Discussion Handout 1: Follow-up Memo to Introduce Class to a Third Decision for Homework Assignment in Figure 1

<p>MEMO TO: Junior business analyst FROM: Ed Green, Manager; Eco-Towels RE: Production planning for sea turtle eco-towels for the coastal market</p> <p>We have a new super eco-towel design. How many regular, deluxe, and super sea turtle eco-towels for the coastal market should we produce next week in order to maximize profit? Please confer with the procurement, operations, and marketing managers for appropriate data and constraints.</p>

Figure 4. Class Discussion Handout 2: Questions to Discuss about Information Required for the Third Decision

<p>What has changed with the new super eco-towel design?</p> <hr/>
<p>Given the new super eco-towel design, what information do you need to gather from the procurement manager to determine the product mix?</p> <hr/>
<p>Given the new super eco-towel design, what information do you need to gather from the operations manager to determine the product mix?</p> <hr/>
<p>Given the new super eco-towel design, what information do you need to gather from the marketing manager to determine the product mix?</p> <hr/>

Once the students have outlined the information needs in class, they are given more information in the form of three additional memos as shown in Figure 5. The students receive a memo from the Procurement Manager with information about the materials required, the material costs, the material supplies, and a material depletion requirement. The students also receive a memo from the Operations Manager with information about the assembly times, assembly labor cost per hour, and the assembly time available. Finally, the students receive a memo from the Marketing Manager with information about the selling price for each eco-towel and that demand is anticipated to be strong. After discussing the memos with new information, the students are given a handout with the original model with extra space for the modifications as shown in Figure 6.

Figure 5. Class Discussion Handout 3: Additional Follow-up Memos with Data Needed to Modify Model

MEMO

TO: Junior business analyst

FROM: Bill Spender, Procurement Manager

RE: Procurement information for sea turtle eco-towels for the coastal market

Each regular sea turtle eco-towel requires 1 meter of regular fabric while each super sea turtle eco-towel requires 1.4 meters of regular fabric. Up to 350 meters of regular fabric can be procured at \$6/meter. Each deluxe sea turtle eco-towel requires 1.2 meters of deluxe fabric which costs \$8/meter. To deplete the current deluxe fabric in stock, use exactly 360 meters of deluxe fabric for the production plan.

MEMO

TO: Junior business analyst

FROM: Ollie Efficiency, Operations Manager

RE: Operations data for sea turtle eco-towels for the coastal market

Each regular, deluxe, and super sea turtle eco-towel requires 4, 5, and 6 minutes of assembly time, respectively. Forty hours of assembly time are available. Assembly labor costs \$12/hour.

MEMO

TO: Junior business analyst

FROM: Melanie Show, Marketing Manager

RE: Marketing insights for sea turtle eco-towels for the coastal market

Produce the regular and super towels with the regular fabric and produce the deluxe towels with the deluxe fabric. Each regular, deluxe, and super sea turtle eco-towel will sell for \$10.80, \$13.60, and \$16.20, respectively. Anticipate strong demand for all three types of sea turtle eco-towels.

The class discussion continues with the students identifying the new third variable for the number of super eco-towels to produce and sell. Then they describe how to modify the objective function by calculating the profit coefficient for the new super eco-towel. Next they explain which constraints are impacted and how. For example, the students must identify that they must add the new decision variable X_3 with the 6 minute coefficient to the assembly time available constraint. In addition, the students must identify that they must add the new decision variable X_3 to the regular fabric available constraint. The students must also determine that they do not need to modify the deluxe fabric depletion requirement since the super eco-towel does not require any deluxe fabric. Finally, the students determine that they must add the new decision variable X_3 to the non-negativity constraints. By the end of the class discussion the students have discovered how to model their first three decision variable problem.

Figure 6. Class Discussion Handout 4: Modifying the Original Model for a Third Decision

<u>Original Linear Programming Model</u>		
Legend:	$X1$	= number of regular sea turtle eco-towels produced and sold
	$X2$	= number of deluxe sea turtle eco-towels produced and sold
Objective Function:	$MAX\ 4X1+3X2$	Maximize profit
Constraints		
1)	$4X1+5X2 \leq 2400$	Assembly time available (minutes)
2)	$1X1 \leq 350$	Regular fabric available (meters)
3)	$1.2X2 = 360$	Deluxe fabric depletion requirement (meters)
4)	$1X1, 1X2 \geq 0$	Non-negativity constraint
<u>Revised Linear Programming Model</u>		
Does the legend change?	If so, how?	
Does the objective function change?	If so, how?	
Does the assembly time available constraint change?	If so, how?	
Does the regular fabric available constraint change?	If so, how?	
Does the deluxe fabric depletion requirement change?	If so, how?	
Do the non-negativity constraints change?	If so, how?	
MARK on the original model below the changes.		
Legend:	$X1$	= number of regular sea turtle eco-towels produced and sold
	$X2$	= number of deluxe sea turtle eco-towels produced and sold
Objective Function:	$MAX\ 4X1+3X2$	Maximize profit
Constraints:		
1)	$4X1+5X2 \leq 2400$	Assembly time available (minutes)
2)	$1X1 \leq 350$	Regular fabric available (meters)
3)	$1.2X2 = 360$	Deluxe fabric depletion requirement (meters)
4)	$1X1, 1X2 \geq 0$	Non-negativity constraint

DISCUSSION AND CONCLUSION

The method presented in this paper requires instructor planning to develop the business scenario and the associated business memos. Larger class sizes, whether face-to-face or online, present a challenge in providing an opportunity for every student to speak in the class discussion. However, the handouts provide an opportunity for every student to write out answers to the questions regardless of whether they have a chance to verbalize them with the class.

In conclusion, using the high impact practice of introducing modeling complexity through role playing a business scenario with professional writing can help students become more engaged in learning about business modeling. As students read through the business memos, they assumed the role of a junior business analyst. In this role, students had the opportunity to identify what changed with the introduction of a new decision and to build the revised model.

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ISLAND WORLD: A SERIOUS GAMING PLATFORM FOR DATA COLLECTION

Matt Campbell, Ph.D., University of South Alabama, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-461-1602, mattcampbell@southalabama.edu

William Glisson, Ph.D., University of South Alabama, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-460-7634, mattcampbell@southalabama.edu

David Bourrie, Ph.D., University of South Alabama, 150 Jaguar Drive, Suite 2101, Mobile, AL 36688, 251-461-1761, mattcampbell@southalabama.edu

Devin White, Ph.D., Oak Ridge National Laboratory, Geographic Information Science and Technology Group, PO Box 2008 MS 6017, Oak Ridge, TN 37831-6017, 865-574-7647, whiteda1@ornl.gov

ABSTRACT

Military conflicts, natural disasters, social policies, financial opportunities, and resource scarcity are just a few of the factors that can motivate people to leave their homes and seek a better life in a new location. When large numbers of people decide to migrate, the demand for resources can overwhelm existing infrastructure and leave governments unable to meet the needs of their people. Policymakers need planning tools that can allow them to understand and predict the movement of people into and out of their borders in order to formulate strategies that mitigate the potential impact. To meet this need, a serious game based tool called Island World was theorized to allow researchers to simulate and then study individuals' reactions to a variety of migration-related scenarios in order to refine predictive migration models.

Index Terms — serious gaming · predictive modelling · stressors · virtual communities · immigration · emigration · migration

INTRODUCTION

According to an Internal Displacement Monitoring Centre (IDMC) report, worldwide internal displacement, due to general violence and armed engagements, reached 38 million people in 2014 [1]. The United Nations High Commissioner for Refugees (UNHCR) reports that the overall number of worldwide forcibly displaced individuals reached a record high of 59.5 million individuals, an increase of 8.3 million over the previous year [2]. Compounding matters, a 2013 United Nations (UN) news report states that international migrants rose above 232 million and that the United States and Europe are destinations of choice [3]. Forced or voluntary international migration can potentially provide countries with valuable resources in terms of a human capital work force [4]. However, it can also be argued that mass migration potentially creates strains for countries in terms of public transportation capacity, infrastructure capacity with issues like power consumption, medical issues like increased risk exposure, and excessive or recessive work force specialization in specific classifications. These increasing trends in migration

coupled with potential strains on countries have encouraged researchers to attempt to acquire a more in-depth understanding of the issues that illicit decisions by individuals and families to migrate to new countries [5], [6].

Attempting to identify and understand the multitude of individual nuances and variables that are integrated into the decision making process for stimulating country migration is a complex and challenging endeavour. Migration variables can realistically include forced displacements due to military engagements, natural disasters, and long-term effects due to climate changes. They can also include societal and environmental needs like a desire for increased income, increased healthcare facilities and capabilities, and agricultural production along with a need for national security and daily safety. Complicating migration analysis is the issue of identifying and differentiating between temporary and permanent migration to a specific country. The reality is that a decision to migrate to a specific country could plausibly be driven by an amalgamation of forced and societal variables with decisions of permanency being modified at will.

The complexities of relevant variable identification and data acquisition in reference to variable impact lead to documenting the proof of concept that gamifying migration presents new opportunities for data capture and migration modelling. The balance of the paper is structured as follows: section two discusses relevant migration research, section three presents the methodology and game design, section four discusses challenges to implementation scope, and section five draws conclusions and presents future work.

RELEVANT WORK

The recent spike in displacement and migration of individuals has renewed interest in researching environmental migration variables [5], [6]. Neumann and Hilderink [5] briefly discuss the difference between fast-onset changes like hurricanes, tsunamis, volcano eruptions, and floods as opposed to slow-onset changes along with living conditions that they label as push factors (i.e., origin country) and pull factors, (i.e., destination country). The authors focus on land cover, land use, cover degradation, and climate variables. The complex relationship between economic, social, and environmental factors make researching pure environmental prompted migration unrealistic [7-9]. For example, Black et al. [7], defines a framework that attempts to clarify the impact of environmental change on migration decisions. This framework identifies five drivers: political, social, economic, demographic, and environmental. Black indicates that key factors that influence a decision to migrate include gender, wealth, education, age, marital status, overall attitudes, and risk preferences. Black indicates that additional obstacles to migration include cost and means to instigate a move along with legal constraints. The broader point made by the authors is that environmental catalysts only represent a single viewpoint that needs to be considered from a broader socio-economic perspective.

Adger [6] provides a review of research themes that investigate different aspects of migration (i.e., climate change) and social factors (i.e., aging, gender, and place). The author states the

need to design adaptive capacity to increase flexibility in policy development. He indicates that there needs to be a greater understating “of how to deal with those displaced by environmental change” within and across state borders [6]. He also indicates that there is an urgent need to protect immigrant rights, understand their economic contribution, and ensure urban sustainability.

Hence, the integration of game theory and game data capture, potentially, provides unique insight into displacement and migration of individuals. Game theory has been described as a nominative theory that “deals with how rational people ought to make decisions in situations involving conflicts of interest” [10]. As Madani points out, game theory and design problems specialize in handling complex, multi-criteria and multi-input scenarios where players strive to maximize their benefit [11].

GAMES AND VIRTUAL COMMUNITIES

As technology continues to integrate into all aspects of society, relevant research in terms of pervasive, serious, and civic game research presents innovative application opportunities. Benford et al. [12], claim that pervasive gaming transcends the gaming experience in the real-world by disconnecting the player from the console and interweaving real world activities at any time and place. “Serious games” is a term that Schollmeyer claims is a euphemism for “decision based simulation” that surpasses video and computer games to interact with more complicated issues for educational purposes [13].

Raphael et al. [14], defines civic games as “games (that) foster civic learning when they help players to develop knowledge, skills, and dispositions that players then apply to public matters in the world outside the game”. Raphael and associates go on to state that there are numerous variables that impact the occurrence of civil learning that include the player’s social position, experience with games, actual game interaction, and player motivations. They also indicate that it is difficult to confirm knowledge acquisition in the gaming world and relevant transfer to the real world. Civic games have also been described as games designed to “involve citizens in public affairs and democratic processes” [15]. While it can be argued that the overall research idea has merit in pervasive, serious, and civic gaming literature, the initial research focuses on the civic applicability.

From a high-level game design standpoint two games in particular influenced the Island World initial research concept. These games attempted to incorporate capabilities that would encourage civic or serious learning concepts, simultaneously facilitating research, and integrate broader virtual communities. The first game is a Massively Multiplayer Online Game (MMOG) called Cosmopolis that is designed to track knowledge exchange while incorporating human actions into virtual experiments [16], [17]. Tenants of the functionality that influences this research specifically focused on “event-based logging of player interactions, isolated experiment frames, and the ability to conduct large-scale in-world events”[16]. The ability to implement

large-scale events and sub-games provides a degree of flexibility that is appealing to cultural, social, and behavioural research. It also integrates the ability to introduce new events that mirror real-world activities as needed in order to support ongoing research ideas.

The second game is Water Wars, a turn based game that integrated real-world water policies. Water Wars attempts to create new community relationships instigated by game designers [15]. The game attempts to encourage critical thinking and prompt understanding, and to provide insight into the issue of water scarcity. Due to resource limitations the Water Wars game was designed to accommodate intermittent activity across numerous sessions. The game engine is able to assimilate other players' actions in order to assume control and ensure game fluidity. While the introduction of game theory to provide insight into the water management issues is not a new issue, the literature does provide application insight [11], [18]. While both games and relevant literature contributed to the design of the Island World concept, neither provides a viable platform for this project's comprehensive research focus.

PREDICTIVE MIGRATION THEORIES

Massey et al. [19] make an interesting suggestion in "that a full understanding of contemporary migratory processes will not be achieved by relying on the tools of one discipline alone, or by focusing on a single level of analysis. Rather, their complex, multifaceted nature requires a sophisticated theory that incorporates a variety of perspectives, levels, and assumption". While there is an abundance of theories that have been proposed to help explain migration, the authors discuss two specific theories of interest to this research. The first is the neoclassical economic theory which focuses on wages and earning potential of the individual, advocating the idea that the volume of migration is directly related to wage maximization [20], [21]. Massey et al., [19] note that this theory yields a clear empirical output creating results which should be verifiable.

Conversely, the second is the new economics theory which focuses on the household/family as a decision making unit [22], the latter taking into account more variables (i.e., market income risk or failure, insurance, and credit). The authors also state that the greatest challenge is "to isolate the influence of market imperfections and risk on international migration from the role of other income and employment variables" [19].

Independently, research has identified opportunities to understand environmental influences in specific situations. Research has also improved understanding of social migration influences in specific environments. However, there is minimal empirical research attempting to isolate the impact of individual variables along with investigating predictive migration through gaming and virtual interaction, thereby yielding novel research opportunities and contributions.

METHODOLOGY

This research investigates the viability of developing a workable proof of concept game that will illicit migration stressors from participants, collect migration data for pattern analysis, provide a platform for future researchers to customize, and conduct migration research. Based on the neoclassical macro-economic theory belief that migration decisions are driven, in part, by individual wellbeing and financial motivations, this research provides the necessary theoretical foundation for solving the following practical hypotheses in the future [19-21].

H1: Individual health is negatively related to a migration event occurring.

H2: Wealth is negatively related to a migration event occurring.

H3: Availability of local employment opportunities is negatively related to a migration event occurring.

Based on the new economics of migration belief that that migration decisions are driven, in part, by non-economic, group based motivations [22], the following future hypotheses are proposed:

H4: Immediate family wellbeing is negatively related to a migration event occurring.

H5: Community wellbeing is negatively related to a migration event occurring.

H6: Political persecution is positively related to a migration event occurring.

Based on the network theory belief that migration decisions are driven, in part, by having contacts in a new country [19], the following future hypothesis is proposed:

H7: Knowledge of a fellow countryman's (social contact) success in a different country is positively related to a migration event occurring.

Previous research has suggested that the rate of change as well as the change of a particular factor itself can have a mitigating impact on the effect of the factor upon the phenomenon of interest [23]. Based on this, we propose the following:

H8: An increased negative rate of change strengthens the relationship between the proposed antecedent and a migration event.

- a) Individual health and migration decision
- b) Wealth and migration decision
- c) Employment opportunities and migration decision
- d) Immediate family wellbeing and migration decision
- e) Community wellbeing and migration decision
- f) Political persecution and migration decision
- g) Social contact and migration decision.

Migration decisions will be controlled by the following control variables: current location, family relationships, gender, and nationality. An overview of the research model configuration is presented in Figure 1.

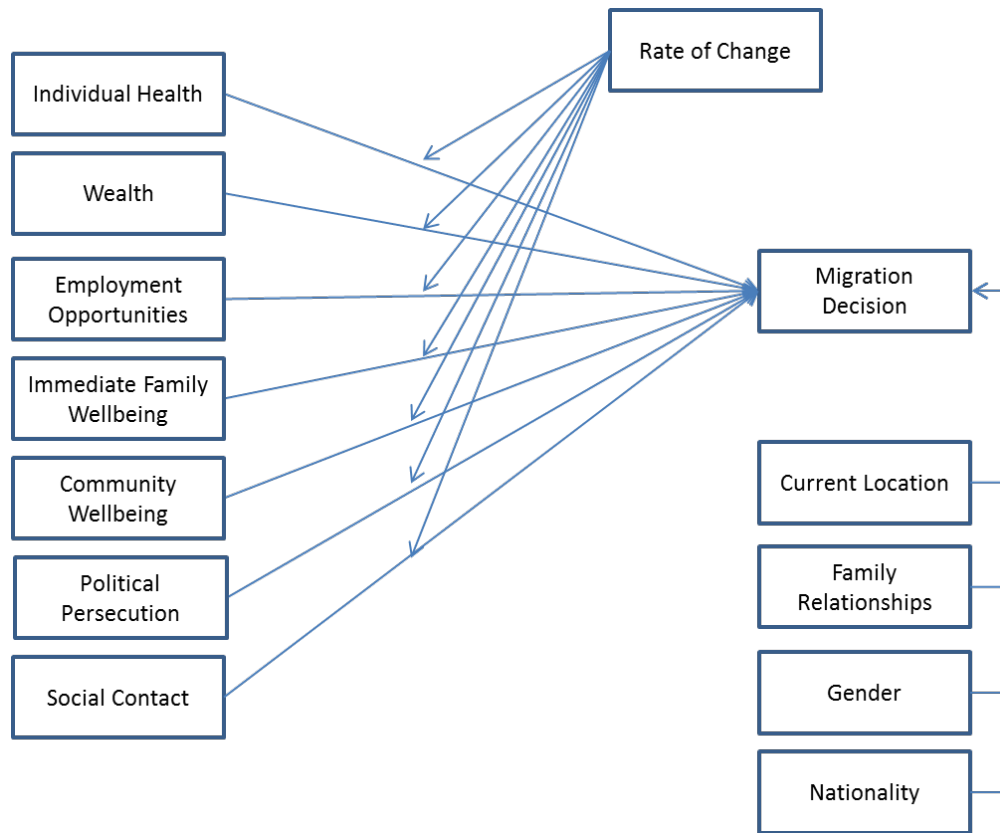


Figure 1. Initial Research Model

ISLAND WORLD GAME DESIGN

Island World is designed to be used by researchers as a highly-configurable, partially-immersive simulation and data collection tool. While the game as initially described has a number of pre-configured scenario cards, researchers are able to add or remove scenario cards and other elements from the simulation in order to present the target group and even each subject with a customized data collection instrument.

Island World allows researchers to assess the impact of stressors such as natural disasters, military attacks, sea level rise, government instability, and limited resources (i.e., food and water) on a virtual community. Stressors such as natural disasters, military attack, and sea level rise can be introduced by the researchers as desired. This research establishes: 1) modifiable game settings that provide researchers with the flexibility necessary to run a range of behavioural game theory type experiments; 2) an unobtrusive game-play mechanism that motivates players to answer survey questions; and 3) generation of player behaviour and game conditions data.

Game Delivery Platform(s)

The game utilizes a client-server design that will allow a light-weight configurable client to be developed for multiple platforms as needed (e.g., iOS, Android, and HTML5) while using the same server-side component for all clients. Game event "cards" can be sent to the client software in real-time or in batches. This design will accommodate players who do not have a reliable Internet connection by allowing batch delivery, receipt, and processing of player responses at the server level.

Initial Game Setup and Customization

After installation, players are asked a series of questions that allow the game to be personalized to their situations. Initial topics will include immediate health, current workload, family relationships, community support, current location, and nationality. Additional questions can be added to meet researcher needs. Players are then presented with a game interface that reflects their current location, individual health, immediate family wellbeing, community support, wealth, employment opportunities, and political climate. Player responses to the questions can be stored locally on the phone until a data connection is available. Players will need to connect to the Internet at least periodically in order to upload response data and download new scenario cards.

Current location: The game will use real-world country data such as names, boundaries, and political environment to start the game. A small flag icon will reflect the current country in which the player is residing in the game. While this will start out being the same as the player's initial physical location, players will have the option to immigrate to another country at any time during the game, at which point their current location flag icon will change to reflect the move. Current location is also reflected by a cartoon-graphic background depicting the area that the player reports they are currently living in (coastal, desert, rural, and urban).

Wealth: An abstract measure of the player's current in-game material wealth on a scale from 1 to 10. This will be displayed using a cartoon-graphic of a pile of money. This value will change based on in-game decisions and scenario cards. When the individual player's wealth is a rated a 10 on a ten point scale, the pile of money will be green. Each one point drop in the wealth score will result in a 10% drop in the tint of the pile of money graphic.

Individual Health: Will be measured using a standard decision analysis approach where a metric between 1 and 10 is derived from probabilities resulting from hypothetical scenario lotteries, where the high and low payouts are based on good health and death [24]. Initial data provided during the games set up will place an individual's health on a scale between 1 and 10. The individual's health will be displayed using a cartoon-graphic of a heart. During the game an individual's health can be impacted by nutrition, disease, and work-life balance. When the player's individual health is rated as 10 on a ten point scale, the heart graphic will be bright red. Each one point drop in the individual health score will result in a 10% drop in the tint of the heart graphic.

Immediate Family Wellbeing: This metric will include individuals who live in close proximity to the player and have close ties with the player. If the player indicates that they live alone, this metric will not be enabled in the game. This will be displayed using a cartoon-graphic of a family. Family wellbeing can be impacted by numerous factors such as the player's ability to feed his or her family, the health of the family, and the amount of time the player has available to spend with the family as well as external factors such as famine, disease, natural disasters, and military conflict. When the player's family wellbeing is rated as 10 on a ten point scale, the opacity of the family graphic will be 100%. Each one point drop in the family's wellbeing score will result in a 10% drop in the opacity of the family graphic.

Community Wellbeing: This metric will include extended family and close friends who reside in the same area as the player and have at least monthly contact with the player. This will be displayed using a cartoon-graphic of a group of people to signify a community. When a player's community wellbeing is rated a 10 on a ten point scale, the opacity of the group of people will be 100%. Each one point drop in the community wellbeing score will result in a 10% drop in the opacity of the group of people.

Employment Opportunities: The number and quality of employment opportunities will be initially set by the researcher based on the player's current location and impacted by scenario cards such as military conflict, disease epidemics, or natural disasters during game play. This will be displayed using a cartoon-graphic of a power plant. When the player's employment opportunities is rated a 10 on a ten point scale, the opacity of the power plant graphic will be 100%. Each one point drop in the employment opportunities score will result in a 10% drop in the opacity of the power plant.

Political Persecution: The level of political persecution will be determined by scenario cards that contain information on government policies that impact the player, his or her family, and community in positive or negative ways. This will be displayed using a cartoon-graphic of hands behind barbed wire. When a player's political persecution is rated a 10 on a ten point scale, the opacity of the hands behind barbed wire will be 100%. Each one point drop in the political persecution score will result in a 10% drop in the opacity of the hands behind barbed wire.

Game Play Design

After initial setup, game play then starts with players being presented with a series of cards, one at a time. Some cards ask the player to make a choice, while others just update the player about a change in his or her environment. Table 1 below lists some example categories of scenario cards. Actual scenario cards used in the game would include a higher degree of detail and multiple cards can exist for a single category. For instance, there may be ten or more cards that offer an option to change jobs. Each would include a different job with different circumstances.

Decision scenario cards can include:	Notification scenario cards can include:
<ul style="list-style-type: none"> - An option to work overtime or spend more time with family - An option to buy a new house or rent - An option to buy a car or take public transportation - An option to purchase immunizations for your family or not - An option to take a vacation or not - An option to change jobs 	<ul style="list-style-type: none"> - Notice of layoffs or new jobs at work - Notice of a natural disaster - Notice of a disease outbreak - Notice of crop failure or a good harvest - Notice of new military conflict or a new peace treaty - Notice of an increase or reduction in taxes - Notice of an increase or reduction in personal rights

Table 1. Example Decision and Notification Scenarios

Cards can be assigned to players randomly or according to the wishes of the researcher. Additional cards can be created by the researcher and presented to the players as needed to facilitate research goals. The researcher can determine the number of cards that are downloaded to the player each time their device connects to the Internet. Researchers collecting data in countries with less reliable Internet connections may choose to give players more cards each time they connect. Researchers collecting data in countries with ubiquitous Internet connections may choose to have the player’s device only download one card at a time.

Emigration

At any time, players can make a choice to leave their current country and immigrate to another country if they can afford the cost of the move. The player’s resources available to pay for the move will come from the wealth category. The cost of the move will depend on whether a single person is moving or if an entire family is moving. Players can investigate opportunities available in other countries by viewing the high scorers list. The high scorers list contains information on other players' country of origin, current country of residence, and wealth and health levels. The information can either be based on actual game data from other players or can be based on researcher manipulated data. It is anticipated that researchers will want to use fabricated data for the high scorers list in order to study the impact that word of mouth has on the emigration decision.

Gaming Interface

On the primary game screen, as displayed in Figure 2, there are a number of graphical representations (dashboard meters) of how the player is doing in the game. Dashboard meters will reflect the current value of the following factors: individual health, immediate family

wellbeing, community wellbeing, wealth, employment opportunities, and political persecution. Additional metrics can be added to the game if desired by the researcher.

The primary display screen will also contain background depicting the area where the player is currently living (urban, rural, coastal, or mountainous). Elements of this scene can change based on the current in-game situation (floods, military attack, etc.) and the individual player's in-game conditions (prospering, surviving, and struggling). Additional backgrounds can be created by the researcher and downloaded to the client software as needed.



Figure 2. Primary Game Screen

Scenario cards, as displayed in Figure 3, will be displayed as a modal pop-up box over the primary game screen and will require the player to either make a choice, if the card is a decision scenario card, or acknowledge the change in game situation, if the card is a notification scenario card, before game play can continue. Dashboard meters will be updated with new information immediately upon close of the modal pop-up.

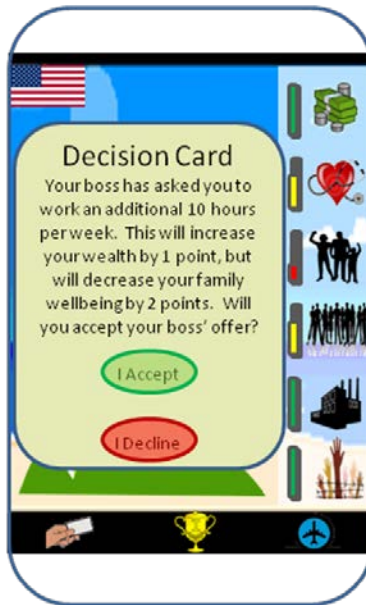


Figure 3. Primary Game Screen with Modal Scenario Card Pop-Up

The primary game screen will also contain links to the high scorers list and the emigration screen as well as a button to draw a new scenario card. The high scorers list, as displayed in Figure 4, will contain a list of the (real or fictitious) leading players in the game, as well as the other players' country of origin, current country of residence, wealth, and health levels. The primary purpose of the high scorers list is to provide information to the player on what opportunities are available in other countries based on a virtual word-of-mouth exchange.



Figure 4. High Scorers Screen

The decision to leave the current country and migrate to a new country in search of better circumstances is available at all times during game play except when a scenario card is

displayed on the screen. The immigration display is visible in Figure 5. The player is able to emigrate as long as they can afford the cost of the move. By default, the cost to emigrate to all available countries is the same unless changed by the researcher. Players have the choice to emigrate alone or with their families. The cost to emigrate for an entire family is much higher than the cost for an individual and may not be available for all countries depending on the wishes of the researcher.

Destination	Individual Cost	Family Cost
	3	4
	2	5
	3	6
	2	4
	3	7
	2	3

Figure 5. Emigration Screen

Game Play Motivations

While researchers often offer financial or other incentives to study participants to complete surveys, a game used for data collection provides its own incentive for participation. The main goal of the Island World game is to accumulate wealth while providing the best possible situation for the player and the in-game representation of his or her family.

The flexible design of Island World allows researchers to determine what game elements will most effectively motivate the target population and then customize the game to include these elements. For example, game editions that target populations who have strong cultural or religious beliefs can be customized to reflect those beliefs without having to recreate the gaming instrument and without impacting the comparability of results from one study population to the next. Additional in-game motivations (such as virtual possessions) or out of game motivation (such as free cell phone ring tones or free music downloads) can be included if deemed necessary by the researchers.

Game Data Collection and Analysis

The scenario card game design of the study allows researchers to manipulate the various factors in order to study the impact that each one plays in the migration decision. This unique design also allows researchers to evaluate the impact of the rate of change on the individual's migration decisions.

The value of each metric will be measured using a relative 1 to 10 scale. The rate of change will be measured using a rolling measure of the change in each metric over the previous 5-, 10-, 20-, and 40-card period. An example of the line chart data that is produced during game play is displayed in Table 2.

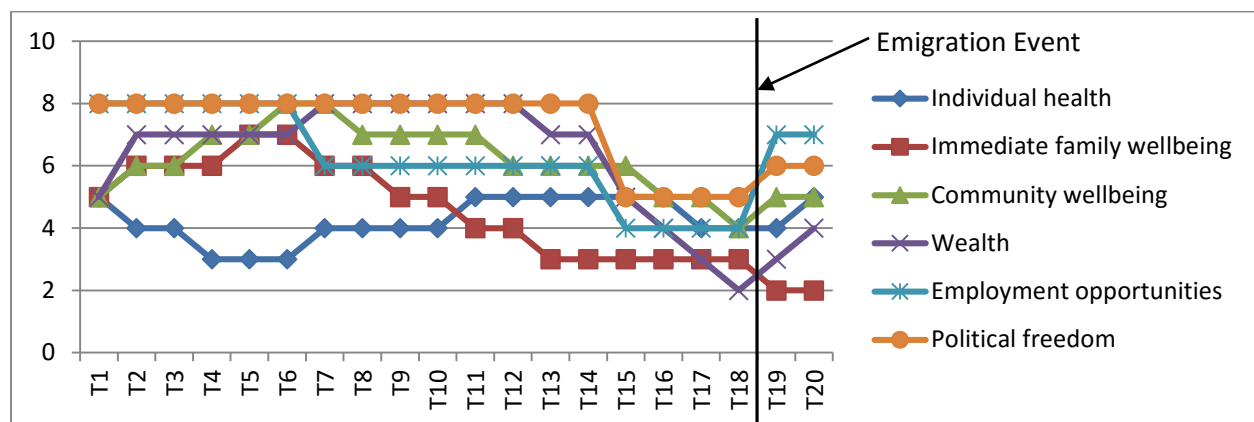


Table 2. Line Chart of Data Produced During Game Play

Since we believe that the migration decision results from an amalgamation of factors such as overtime and instead of a single event, we will use a time-lagged regression analysis similar to that used in Campbell [25]. Each time a player chooses to migrate to another country, this constitutes time zero for that observation. For each observation, we will examine the value of each variable in our model over the previous 5-, 10-, 20-, and 40-card time periods to determine the overall rate of change for all of our proposed antecedents in the model. This longitudinal data will then be entered into a regression analysis.

IMPLEMENTATION SCOPE LIMITATIONS

There is preliminary research that indicates that gaming solutions can be effective in supporting learning in reference to development processes, team member interdependencies, overall organization and complex problem solving [26]. In addition, researchers have suggested role-playing games reduce the risks inherent in other forms of self-reported data collection methods when studying interactions between individuals and groups [27]. However, great care must be taken to construct the game in such a way that in-game behaviour can be accurately linked back to real-world decisions in order not to bias the results. In addition, the usefulness of the data

generated by the game is directly related to the number of individuals playing the game from the same country and other countries.

There were design tensions that made it challenging to ensure that the game was engaging to play while at the same time keeping the game useful as a data collection tool. These challenges ranged from how often the game introduces fast-onset vs slow-onset environmental changes to balancing push and pull societal incentives. Additional design tensions were experienced when selecting Island World's graphics. The game's graphics needed to be simple yet detailed enough to support a range of research options and scenarios. Similarly, debates focused on player location representation accuracy versus memory and load time impact. It is important to strike a balance between maintaining a small application footprint while also providing a recognizable environment for the game. This is an instance in which gameplay concerns affected our ability to enhance Island World's research features set.

The current proof of concept design targets intentional migration decisions based on individual health, family wellbeing, community wellbeing, wealth, employment opportunities and political freedom. It also attempts to take into account the impact of natural disasters and military conflicts. While the game is designed with a high degree of flexibility to allow the introduction of new variables in the future, all other variable are considered out of scope for this proof of concept.

CONCLUSION & FUTURE WORK

While no game will produce completely reliable data in terms of real-world decision scenarios, the game has the potential to provide valuable insight into environmental and societal variable importance. It also presents a unique opportunity to acquire and compare international data for cultural comparisons. In addition, Island World presents the opportunity to implement big data algorithms to investigate player decisions in specific local and global environments and given specific fast-onset, slow-onset and push and/or pull scenarios.

Immediate plans focus on the initial deployment of the proof of concept application to acquire realistic feedback and application testing from players in different countries. This research will also examine the implementation of various behavioural game theory models for data collection purposes. The initial goal will focus on gathering sufficient user feedback to further refine the game and ensure that it correlates environmental stressors as closely as possible to their impact upon human migration behaviour. Future work will also investigate the feasibility of incorporating big data and data-mining algorithms which could potentially uncover new decision making patterns in terms of migration decisions and patterns.

Future research will build, implement, refine, and ultimately deploy a production ready version of Island World. This research will also explore enhancements that will increase the pervasiveness of the game. One of the main goals of this research is to enable government policymakers to better plan for and deal with the problems caused by human migration. This is a non-trivial issue

since governments must make services available as well as inform migrants about their existence and convince migrants to trust them. This can be difficult when migrants originate from cultures that typically do not trust governmental authority.

Another area of research interest is the impact of migration on international and domestic transportation infrastructures. Accurate predictions of migration patterns would allow authorities to implement tailored mitigation strategies for the individual modes of transportation (e.g., air, water, rail, and motor). Improving transportation infrastructures, potentially, positively impacts the cost of transporting commercial products, reduces passenger cost by maximizing fuel consumption while minimizing lost passenger capacity, and assists in maximizing private and national security resources.

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Data without Borders: Privacy, Data Ownership and Legal Concerns for Data in the Cloud

Cynthia Knott

Xiang Michelle Liu

Diane Murphy

Marymount University

School of Business Administration

Arlington, VA 22207

Abstract

As cloud storage services became the vehicle of choice for storing and processing large amounts of corporate data, a Chief Information Officer (CIO) or Chief Data Officer (CDO) must ensure that they fully understand the implications of such a strategy, given the increased focus on data security and the continuously evolving laws and regulations on data privacy and compliance. Global data storage options are readily available through the major cloud providers, each with a variety of storage locations. This paper looks at some of the major location-specific issues that should be considered before making a cloud hosting decision, particularly for storing personally identifiable information (PII). Several issues are discussed including data ownership considerations, access from law enforcement agencies, and the transfer and sharing of data from one location to another. What complicates these issues is the constantly changing landscape as litigation makes its way through the global legal systems for the first time and new laws and regulations are introduced.

Introduction

The way businesses operate today has no doubt changed, thanks largely to the Internet. All around us, economies operate on a much more global scale, powered by technology. The emergence of cloud computing has fundamentally changed the way that people communicate with each other and the way that data is generated, stored and shared. Technology has also affected the volume of data stored, including the large amounts of personally identifiable information (PII). However, many organizations seem ambivalent about the impact of cloud-stored data, and its privacy, focusing more on the cost and benefits of the cloud solution. Traditional security and privacy models may not be applicable, or can even be in conflict, with many features of cloud computing, particularly from large cloud providers with a global presence, such as Amazon, Microsoft or Google.

How important is it for an organization to know where the data is stored on the cloud, including backups, and how it is transferred from that location to another? What should an organization know about their data residing in the cloud? Can the data location affect their rights to process that data and protect its privacy? Should an organization be able to stipulate where their data is stored? These are all questions that should be answered by the CIO or CDO before making a cloud provider decision.

Data privacy is a fast changing field as regions, countries, and even states implement new privacy laws with little understanding of the implications of cloud technology. The European Union, with some of the strongest privacy laws, houses much of the cloud data and there are a number of litigation actions currently in process between the major cloud providers and the data stakeholders, including law enforcement bodies seeking to find information on suspects.

In this paper, the authors look at the current status of trans-border data privacy in the cloud environment and raise a number of concerns about data loss that need to be explored before an

organization makes a commitment to a specific cloud provider, including knowing the storage locations.

The Conundrum of Trans-Border Data Residency

One of the characteristics of cloud computing, in fact, also frequently cited as a selling point, is that data storage and processing capacity can be moved and shared between a provider's resources on a global scale (Bradshaw, Millard & Walden, 2010). Data centers are located in different countries around the world. However, this while seemingly seen as an advantage, it could be a double-sided sword. It has also resulted in one of the most frequently-raised concerns and ambiguities regarding cloud computing— that a cloud service user's data may be stored, transferred or processed in a completely different, or even unknown, jurisdiction without the user's awareness of the consequences, including data security and privacy.

Data privacy concerns have been acknowledged as one of the most critical topics by practitioners and researchers as well as being commonly cited as a major reason impeding cloud service adoption (Wenge et al. 2014; Hon, Millard & Walden, 2011). For example, one survey conducted by PricewaterhouseCoopers (2013) showed that areas such as data privacy, compliance requirements, and information security are increasingly a concern for companies. Another survey report conducted by KPMG (2014) revealed that 53 percent of the survey respondents regarded data loss and privacy risks as the most significant challenges of doing business in the cloud. These concerns about data privacy are amplified when cloud services involve trans-border data flows.

The well-respected NIST (National Institute of Standards and Technology) SP (Special Publication) 800-144 notes that the governing legal, privacy, and regulatory regimes can be ambiguous when data crosses borders (Jansen & Grance, 2011). Some of the main concerns documented in this publication include:

- Whether the laws in the jurisdiction where the data was collected permit the flow of data outside the boundary;
- Whether those laws continue to apply to the data after it has been transferred; and
- Whether the laws at the destination present additional risks or benefits.

Key Considerations of Data Privacy in Cloud

There are several key considerations around the business aspect of an organization's trans-border data storage and use.

Does the location matter?

Cloud computing has blurred traditional geo-political boundaries, therefore, verifying data locations can be difficult. Understanding data residency (sometimes called data sovereignty) has become one of the top priorities for IT security professionals whose organizations use cloud services for large-scale data storage. A recent survey by the Ponemon Institute found that only 16 percent of IT and cybersecurity professionals know where all of their sensitive data resides

and the majority of respondents agree that not knowing the location of data poses a serious security threat to the organization (Ponemon Institute, 2014).

Further, such uncertainty obscures the organization's knowledge and control over the potential regulatory risk resulted from the jurisdiction where the data is held making compliance more complex (Vaile et al., 2013). For example, one study conducted by Fieldfisher (2015) in 47 countries across 6 geographical regions revealed that 94% of the countries analyzed have "data residency rules" in place. This means that those countries have national data protection laws prohibiting organizations from transferring personal data outside of their country or region unless certain legal standards are fulfilled (Fieldfisher, 2015). Only three of the countries analyzed do not have any "data residency rules", including the United States, South Africa and New Zealand. Although the U.S. does have data privacy protection in different sectors such as financial services and healthcare regimes, it has no nation-wide data protection law regarding data transfer restrictions.

Complicating the U.S. situation are the many different state data privacy laws on the books. Very recently, the state of California passed its own Electronic Communications Privacy Act that prevents any state law enforcement agency or other investigative entity from compelling a business to turn over any metadata or digital communications—including emails, texts, documents stored in the cloud—without a warrant¹. Five other states have similar warrant protection on data content.

One of the best known examples of a "data residency rule" is the Data Protection Directive (DPD), officially Directive 95/46/EC, adopted by the European Union (EU) in 1995. It is designed to protect the processing and moving of an individual's personal data². Included under this legal framework are the so called "safe harbor" provisions which govern the trans-border flow of data between the EU and other countries. The US version of "Safe harbor" was developed jointly by the U.S. Department of Commerce and the EU in 2000 and was intended to streamline the process of transferring data including personal information, from the EU to the U.S.³ However, it is worthy to note that Europe's top court invalidated the "safe harbor" agreement between the U.S. and the EU on October 6th, 2015 as a result of a legal complaint filed against Facebook in Ireland by a Facebook user (USA Today, October 6th, 2015)⁴. The plaintiff argued that the revelation of NSA's massive surveillance practices showed that the "safe harbor" was not an effective mechanism to ensure sufficient protection of private data as it was supposed to, therefore, Facebook acted illegally by transferring the plaintiff's private data from Ireland to its servers in the U.S. This decision to reject the 15-year-old safe harbor agreement basically puts the legal judgment under the jurisdiction of Irish authorities. The consequences of this ruling have far-reaching impacts on how companies transfer and share data between their EU

¹ The news was retrieved from http://www.wired.com/2015/10/california-now-nations-best-digital-privacy-law/?mbid=social_twitter on October 11, 2015.

² Access more detailed information from the document titled *Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data* at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1995L0046:20031120:EN:PDF>

³ Refer more information on the US-EU Safe Harbor from http://export.gov/safeharbor/eu/eg_main_018365.asp

⁴ The news was retrieved from <http://www.usatoday.com/story/tech/2015/10/05/european-privacy-ruling-could-hurt-us-companies/73422412/> on October 8, 2015.

and U.S. data centers. Without the “safe harbor”, it depends on each individual EU country authorities to make legal decisions as for whether the U.S. companies provide equivalently adequate protections of personal data in their U.S. data centers.⁵

Regarding data storage locations and its associated issues, Gartner presents a general guide in one of its research reports (Casper, 2014). This report defines four types of data locations: physical location, legal location, political location and logical location. Physical location refers to the geographic location where the data is stored. Legal location is determined by the entity controlling the data even though it may be processed by an entity in another physical location. Political location of data includes "considerations such as law enforcement access requests, use of inexpensive labor in other countries that puts local jobs at risk or questions of international political balance." The Gartner researcher suggests that logical location is the most important determinant in who has access to data.

A useful example in the report helps people understand the implication of these four types of data locations. A German company signs a contract with the Irish subsidiary of a U.S. cloud provider, however, a backup of all data is physically stored in a data center in India. In this case the legal location of the cloud provider would be Ireland, the political location would be the U.S. and the physical location would be India. Further, the logical location of all data could still be in Germany. As the report pointed out, “None of the types of data location solves the data residency problem alone... eventually, it's the business leader who has to make a decision, based on the input from general counsel, compliance officers, the information security team, privacy professionals and the CIO.”

Who Has Jurisdiction?

Cloud storage services may be used for criminal activities or they may be attacked by organized crime rings or other hacker organizations. For either scenario, law enforcement agencies need to access data held in cloud services for forensic purposes during the course of an investigation (Walden, 2011). Such forensic data may be held in data centers located in foreign physical or logical jurisdictions. Can law enforcement agencies legally access information stored in cloud service provider's data centers outside of its geographic border? Although the answer may remain ambiguous, cloud providers are concerned that any possibility for such access will generate security and privacy concerns and may affect the “trust” relationship with their users. Therefore, it is important to examine this question and raise awareness of such potential issue. A variety of factors must be considered including the location of the owner of the content, the location of where the content is stored, the location of the company that owns the storage where the content is stored and the location of the individual about whom the content may pertain.

This intricacy derives from the lack of standardization on the definition as well as interpretation of privacy across different countries and regions. For example, even under the same umbrella of the DPD provisions, the different EU Member States have different interpretations of the data protection rules due to “variations in the implementation of the DPD into national law” (Hon, Hörnle & Millard, 2012, p.6). As the scope of this paper mainly focuses on U.S. cloud service

⁵ The information was retrieved from <http://www.wired.com/2015/10/tech-companies-can-blame-snowden-data-privacy-decision/> on October 8, 2015

providers with global data centers, the discussion will be centered on the U.S. regulatory requirements associated with obtaining access to personal data.

The U.S. federal government can assert extraterritorial claims on data through the USA PATRIOT Act⁶ which allows the US government to obtain personal information held by U.S. companies even though the physical storage location of such information is in a foreign country with different jurisdiction. Thus, if cloud data is hosted by a US-based company anywhere in the world, it is potentially subject to the PATRIOT Act (Vaile et al., 2013). There was a great deal of discussion when the PATRIOT Act expired in 2015 but its provisions, except the storage of phone data by NSA, have now been extended through 2019 by the USA Freedom Act⁷. Many legal disputes may arise from such controversial cross-geopolitical and jurisdictional legislation.

Another relevant piece of legislation that plays a role in the jurisdiction issue is the federal Electronic Communications Privacy Act (ECPA) of 1986⁸. It has been widely criticized for its obsolete provisions that the US government can compel a service provider to disclose the contents of an email that is older than 180 days with only a subpoena (Vaile et al., 2013).

In terms of international-level cooperation, the U.S. has established mutual legal assistance treaties (MLATs) with the EU as well as over 50 countries. The bilateral MLATs allow governmental authorities on both sides to request access to data stored on the servers of a cloud service provider physically located in, or subject to, the jurisdiction of a foreign nation (Maxwell et al., 2012). However, the MLAT procedures are so complex and bureaucratic that they have been largely unsuitable or unrealistic for cloud-based investigation (Walden, 2011).

A recently pending case between the U.S. Department of Justice (DoJ) and Microsoft Ireland stirs the hornet's nest⁹. This case reflects some "grey-area" questions and issues around cloud data privacy, ownership and control. In summary, a US judge was trying to force Microsoft to hand over e-mails sitting in the company's Irish data center and Microsoft refused to turn over this content. The DoJ contends that emails should be treated as the business records of the company hosting them and only a search warrant would be needed in order to compel the provision of access to them no matter where they are stored under the ECPA of 1986. Microsoft argues this is extraterritorial, that a US judge has no authority thus cannot subpoena data (stored in a data center in Ireland) outside its US operations¹⁰. Microsoft insisted that the Government could compel disclosure of content stored in Ireland using the Ireland-U.S. MLAT instead of a search warrant¹¹. A ruling of this case may come in February, 2016.

⁶ USA PATRIOT stands for Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism. It can be accessed from <http://www.gpo.gov/fdsys/pkg/PLAW-107publ56/content-detail.html>

⁷ Obtain more information from <http://judiciary.house.gov/index.cfm/usa-freedom-act>

⁸ Refer the following website for more detailed information about the ECPA.
<https://it.ojp.gov/privacyliberty/authorities/statutes/1285>

⁹ Retrieved from <http://www.infoworld.com/article/2859897/internet-privacy/microsoft-vs-doj-the-battle-for-privacy-in-the-cloud.html> on October 11, 2015

¹⁰ Retrieved from <http://www.theguardian.com/technology/2015/sep/09/microsoft-court-case-hotmail-ireland-search-warrant> on October 11, 2015.

¹¹ Retrieved from <https://cdt.org/insight/microsoft-ireland-case-can-a-us-warrant-compel-a-us-provider-to-disclose-data-stored-abroad/> on October 11, 2015.

Conclusion

For the CIO, cloud storage makes good sense from an economic perspective, particularly when such data is likely to grow unpredictably. However, for the CDO, data privacy must be a prime consideration, particularly when data is known to be company sensitive or to contain personally identifiable information (PII) for employee or clients. Ensuring the security of the stored data is one aspect of the solution, but understanding the data privacy risks are also important. “Data residency rules” must be fully understood for the physical and logical locations. The cloud provider must disclose all locations of where your data will be stored, including where backups are held, and if possible, allow selection of the appropriate location by the cloud user. In addition, the CDO should be staying aware of legal and regulatory changes, as data privacy is a fast-changing field. It is expected that additional litigation is on the way between cloud users, cloud providers, and other stakeholders such as law enforcement organizations. It may take years before there are clear, unambiguous guidance for location-specific data privacy and security.

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ANALYZING A SIMULATION MODEL FOR DISASTER RELIEF SUPPLY CHAIN: A CASE STUDY

Keli Feng, South Carolina State University, 300 College St NE, Orangeburg, SC, 29117, 803-533-3689, kfeng1@scsu.edu

Jae-Dong Hong, South Carolina State University, 300 College St NE, Orangeburg, SC, 29117, 803-536-8861, jhong@scsu.edu

ABSTRACT

Over the last three decades, natural or man-made disasters globally claimed more than 3 million lives, caused tremendously property damages and losses, and adversely affected at least 1 billion people's lives. To better prepare for disasters, reduce casualties, and alleviate the disastrous victim sufferings, we need a better disaster relief supply chain that can help emergency management planners make better disaster related decisions. In this study, we design and develop a simulation model of two-stage disaster relief supply chain, which includes regional warehouse stage and Point of Distribution (POD) stage. This two-stage supply chain design is compared to the FEMA's supply chain structure, which includes five stages: Point of Distribution (POD), State Staging Area (SSA), Federal Operations Staging Area (FOSA), a Mobilization Center (MOB) and Logistic Centers. For both supply chain structures, continuous review inventory policy and cross-docking policy are used to manage the relief inventories. The main performance measures include demand coverage rate, total inventory costs, deprivation costs, transportation costs, inventory level, and backorder level. The developed simulation model is evaluated and validated through a case study applied to an imaginary hurricane/flood disaster in South Carolina, but the model can be generalized to cope with other types of disaster events. Based on the case study, sensitivity analyses is conducted to identify the most critical input factors. The computational results illustrate the impact of increased demand and inventory pre-position on the main performance measures. The paper is concluded by a summary of lessons learned from the model based on the case study.

Logistics Optimization and Routing Planning: A Case Study of a City's Garbage Collection Operation

Gustavo Cruz¹

¹MBA student, Anderson University

Abstract

Organizations in both private and public business have been using logistics optimization methods to reduce cost, increase productivity and maximize customer satisfaction. Generally, it is applied in solving complex problems. Logistics optimization in routing planning and scheduling can create methods to allow the operation to achieve optimal performance levels. Governmental entities and organizations such as state and local governments have a history of not being as productive as the private sector because many cities logistic operations are not using optimization methods to increase performance.

After a brief introduction and literature review in logistics optimization, routing and scheduling planning, this paper focuses on a case study that takes place in a small to medium sized municipality in the southern United States, and studies the garbage collection operation. The City studied has been growing in the last few years, and its static routing system does not seem to be the best method for garbage collection. While optimization processes seem as important to cities logistics operations as other businesses, there are some challenging constraints as lack reliable historical data and constant political interference that are complex challenges to optimization. The City is divided into five regions and each one is serviced one day of the work week. Through data collection from a GPS system, data analysis, industry benchmark and literature review, this study case aims to provide both an analysis of the current method, as a proposal manual routing planning method to its optimal level, finding routes to minimize both time and travelled mileage. This study also explores maximizing operational outcomes while minimizing the need for complex routing techniques or expensive computerized routing and maintenance. The expected result will be lower cost, higher performance, key performance indicators and citizen's satisfaction.

IMPROVING PROFITS BY OPTIMIZING THE SHIP'S SAILING SPEED

Burcu Adivar, School of Business and Economics, Fayetteville State University, 1200 Murchison Rd., Fayetteville, NC 910-672-1362, badivar1@uncfsu.edu

Cansu Kasapoglu, School of Business, Izmir University of Economics, Balçova, Izmir, Turkey 35320, cansu_kasapoglu@hotmail.com

ABSTRACT

In this study, we emphasize the importance of reduced fuel consumption in terms of reduced costs and reduced emissions in maritime transportation. Maritime transportation is the most preferable transportation mode due to large capacity without overdraft restrictions, reliability and low cost. In the literature, there are studies focusing on the reduction of the international maritime transportation costs by optimizing ship routing and sailing speeds. Indicating that fuel constitutes the most important operational cost category in maritime transportation, we consider factors affecting the fuel consumption. By pointing out the nonlinear relationship between fuel consumption, speed, and the payload we develop mathematical programming models to maximize profit from the ship-owner's or ship operator's point of view. While trying to find the optimal speed, we also consider the payload effect, demand variability and different types of loads.

Keywords: Payload; Optimal ship speed; Ship capacity and Profit maximization

INTRODUCTION

Maritime transportation is the most preferable transportation mode due to large capacity without overdraft restrictions, reliability and low cost. On the other hand, consumption of high volumes of low-quality fuel in maritime transportation is raising serious environmental issues. Many studies have been conducted for improving maritime fuel consumption's negative effects and transportation emissions. Fuel costs constitute the largest expenses for ship operations. According to the World Shipping Council WSC (2008), fuel costs represent approximately 50-60% of total ship operating costs. Therefore, ships try to reduce fuel consumption by travelling at low speeds, which is known as slow steaming and commonly implemented by numerous carriers since the economic downturn in 2008.

Since reducing fuel costs is important for both reducing emission and increasing profit, we need to analyze factors affecting the fuel consumption. Fuel consumption is affected by shipping route, sailing speed (ballast or laden speed), waiting times at the port and the ship design. It is important to note that laden (loaded) ship consumes more fuel compared to ballast (empty) ship. In addition to these factors, the loading and unloading times at the port are also important for fuel consumption. Considering that ports have different rules, e.g. some ports do not work during the weekend or holidays, timing and speed optimization are critical for ship owner's or ship operator's decision making problem. Ship owners have to consider all these factors during fleet planning, scheduling and routing. Sometimes ships have to sail at maximum speed to minimize trip time.

Due to uncertainties in sailing times and service times, every ship is given a time window specifying the earliest and latest arrival time to a port. In order to catch these time windows, ships adjust their speed and sailing time from departure port to the arrival port. If the ship speed is reduced by 20%, fuel consumption may be reduced by 50% (Ronen et al., 1982). Figure 1 shows the nonlinear relationship between speed and fuel consumption. Every ship has design speed interval, which is typically between 10 and 30 knots. For a given distance, optimal sailing speed is observed as 15 knots (Figure 1). Fuel consumption also affects emissions, which are closely monitored by International Maritime Organization’s MARPOL convention.

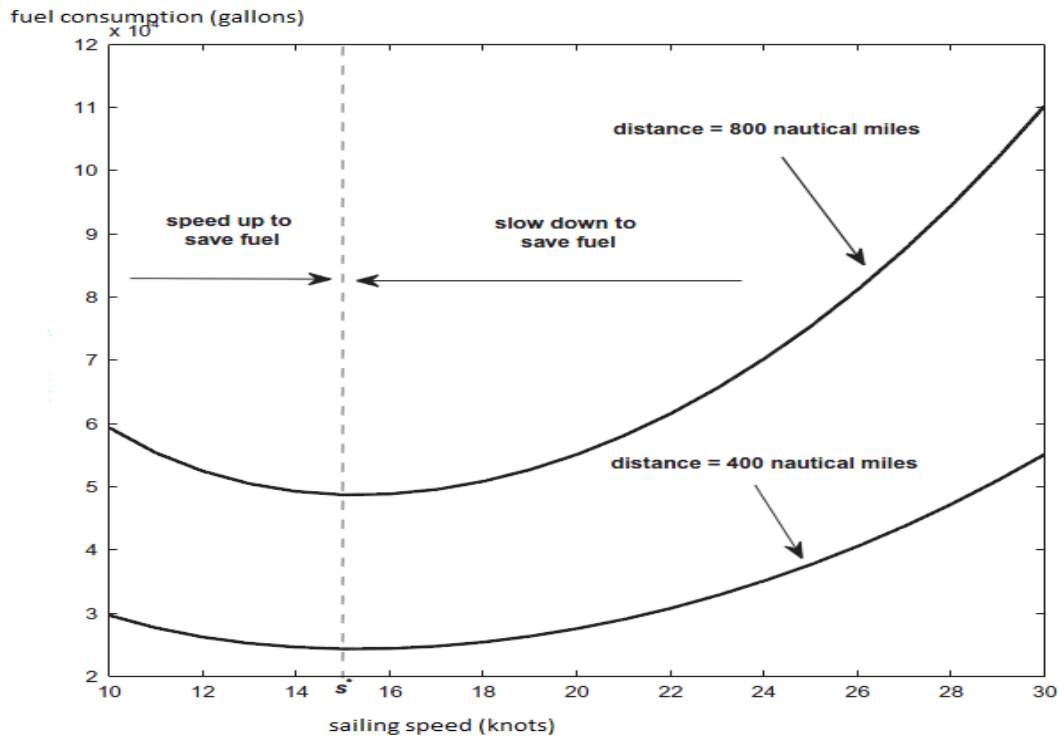


Figure 1. Fuel consumption between speed curve sources; *Du et al. (2011)*

The nonlinear relationship between speed and fuel consumption can be represented by a quadratic or cubic function. In the literature, there are several fuel consumption functions, all of which are single variable function of speed (i.e. $f(v) = 0.0036v^2 - 0.1015v + 0.8848$). Note that although this function represents the quadratic relationship between fuel consumption and the speed, it does not consider the effect of payload on the fuel consumption. Based on our literature review, we point out two important gaps in the literature. First one is the need for a new fuel consumption function, which considers not only sailing speed but also payload. The second need is related to the competitive disadvantage of slow speed in terms of tied-up vessel capacity and lost revenues. Especially for multiple voyages over longer term e.g. a year, speed reduction may not be a good choice since it increases the voyage duration and cuts back the number of voyages and the total profit. Therefore, in this study, by focusing on maximizing profit in the long term, we try to fill these two gaps by answering the following research questions;

1. How do speed and payload affect the fuel consumption?

2. Given the ship type, capacity, route, supply and demand, how can we maximize the ship's profit considering related costs?
3. How different demand scenarios affect the optimal sailing speed?

Since the slow steaming became a common practice, ship liners started to offer alternative shipment schedules (slow and expedited) at different costs for their customers. Shippers are usually willing to pay the extra premium to ship certain products faster. For perishable products such as fish, the freight rate is time sensitive therefore ships may travel at higher speed and earn higher freight revenue. However, for durable items freight rate is independent of the sailing time and revenue does not change with speed. Therefore, our profit maximization model is analyzed for two different product types (perishable/time-sensitive and durable/time-insensitive) under three demand scenarios: high, medium and low.

LITERATURE REVIEW

In this Section, we review the literature and provide a summary of related literature on fuel consumption and speed optimization. In Maloni et al. (2013), authors address speed reduction, fuel savings and the emissions as the advantages of slow steaming especially for carriers and shipping lines. With increased sailing times and higher inventory costs for the shippers, the effects of reduced sailing speed on supply chain performance are discussed in several studies including Lee et al. (2015), Fransoo and Lee (2013). We focus on studies that consider optimization models with speed, freight rate, ship's weight, crew cost and service time from the liner's perspective. We have searched the Scholar Google database using keywords "Payload"; "Ship speed"; "Ship capacity" and "Ship emission". Our search resulted in 61 articles published between 1982 and 2014. After scanning these studies, we compared modeling characteristics of some articles in Table 1.

Wang et al., (2013) study fuel consumption problems considering the demand for shipping. For instance, the demand for maritime transportation in 2011 was 8.4 billion tons. Oil is the main product creating demand for transportation. *Notteboom (2009)* analyzed the oil price increase and created a cost model showing the relationship between bunker fuel consumption. It is an important decision to determine the shipping capacities, speed and fuel consumption. Vessels try to minimize the annual operating cost of the route. Due to reduced demand and increased oil prices, containership operators try to reduce fuel costs by reducing sailing speed of their vessels. Another study by *Ronen (2011)* provides a model that determines optimal speed to minimize the operating cost. A recent study by *Meyer et al. (2012)* investigates the economic and environmental impacts of speed reduction focusing on optimal speed function.

Yao et al. (2012) study several bunker fuel management strategies considering different factors including port selection, ship size, ship speed and routes. Their model represents relationship between fuel consumption and ship speed. *Psaraftis et al. (2013)* study ship's speed and try to reduce the speed for environmental effect. Reduced speed provides benefit for emissions and fuel consumption. There are several speed optimization models (*Fagerholt et al. 2010, Corbett et al. 2009, Psaraftis et al. 2014*) in maritime transportation, where speed is considered as the decision variable. Speed optimization results in cost reduction and/or profit maximization.

Table 1. Summary of literature review

Taxonomy parameter/ Authors	Psaraftis et al. (2013)	Kontovas et al. (2014)	Fagerholt et al. (2009)	Psaraftis et al. (2014)	Sánchez et al. (2003)	Ronen et al.(1982)	Tongzon (2009)	Psaraftis et al. (2009)	Christiansen et al.(2011)	Gambarde lla et al. (1996)	Chung (1993)	Ronen (2011)	Kontovas et al. (2009)	Tai et al.(2013)	Song et al.(2012)
Optimization criterion	cost	emissions	cost	profit	cost	profit	profit	cost	cost	profit	cost	profit	cost	emissions	cost
Decision maker	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner	owner
Fuel consumption function	yes	yes	yes	no	no	yes	no	no	no	no	no	no	yes	yes	yes
Optimal speed	yes	no	yes	yes	no	yes	no	yes	no	no	no	yes	yes	yes	yes
Inventory cost included	yes	no	no	no	yes	no	no	no	no	no	no	no	no	no	
Fuel price an explicit input	yes	yes	yes	no	no	yes	no	no	no	no	no	no	yes	yes	yes
Emissions considered	yes	yes	no	no	no	no	no	yes	no	no	no	yes	yes	yes	yes
Port included	no	yes	no	no	yes	no	yes	no	yes	yes	yes	no	yes	no	no
Sailing speed	no	no	yes	yes	no	yes	no	no	no	no	no	yes	yes	no	no
Routes included	no	yes	yes	yes	no	no	yes	no	no	no	no	no	no	no	yes
Freight rate input	no	no	no	yes	yes	yes	no	no	no	no	no	no	no	no	no
Load-Unload	no	no	no	no	yes	no	no	no	yes	yes	yes	no	no	no	no
Operating cost	yes	no	no	yes	no	yes	no	no	no	no	no	yes	no	no	no
Payload for ship	yes	yes	yes	yes	no	no	no	yes	no	no	yes	no	yes	no	no

Brouer et al. (2014) propose a routing model to maximize the revenue of the ship. Fagerholt et al. (2010) propose a speed optimization model for each leg on a given route and develop alternative solution algorithms. According to this study, emissions are reduced by the shortest path solution. Fagerholt et al. (2015) consider sailing speed, and time window constraints in route selection problem. Route selection decision has significant effects on emissions, fuel consumption and total profit. Therefore, in Kontovas et al. (2014), Qi et al. (2012), Green Ship Routing and Scheduling Problem (GSRSP) is defined as an optimal scheduling problem and tackled by simulation based methods. Authors consider the same problem to define optimal route to minimize fuel consumption and emissions.

Every ship has different port time at the port for loading, unloading. Psaraftis et al. (2014) study ship routes and observe that every ship has different main routes on which they transport laden in one direction, and transport ballast in the other direction. However, liner shipping has its unique characteristics, i.e., ships are usually deployed on a closed route with weekly frequency following a published schedule of sailings with a fixed port rotation, and laden/empty containers are loaded on/off the ships at each port-of-call (Song et al. 2005; Ronen, 2011).

Fagerholt et al. (2010) propose the following speed optimization model on a given route with specified time windows for seven ports. The fuel consumption function is quadratic and based on sailing speed only.

Notation for the model in Fagerholt et al. (2010).

$k=1,2,\dots,n$	Index for ports on the route
$d_{k,k+1}$	Distance between port k and k+1
f	Fuel function
$v_{k,k+1}$	Ship's speed between k and k+1
t_k	Arrival time to port k
$t_{k,k+1}$	Sailing time from port k to port k+1
e_k	Earliest arrival time at port
l_k	Latest arrival time at port k
f_v	Sailing consumption per distance $f(v)$.

$$\text{Minimize } \sum_{k=1,\dots,n-1} d_{k,k+1} f(v_{k,k+1}) \quad (2.1)$$

$$\text{Subject to; } t_{k+1} - t_k - d_{k,k+1} / v_{k,k+1} \geq 0, \quad k = 1, \dots, n-1, \quad (2.2)$$

$$e_k \leq t_k \leq l_k, \quad k = 1, \dots, n, \quad (2.3)$$

$$v_{\min} \leq v_{k,k+1} \leq v_{\max}, \quad k = 1, \dots, n-1. \quad (2.4)$$

In this model, Equation (2.1) is the objective function; the aim is to minimize the fuel consumption, which is a function of ship speed. We note that objective function is convex and nonlinear. Equation (2.2) ensures that ship is not started service before it arrives at port k by ship-owners. Equation (2.3) defines earliest, latest time window (days) constraints. Equation (2.4) determines ship's lower and upper speed (14-25 knots).

In the literature, several investigators propose models including fuel consumption function with the objective of emission reduction, ship speed optimization, and efficient use of ship capacity. However, none of these studies considers the payload affect on the fuel consumption. Therefore, we propose a new fuel consumption function which considers speed and the payload at the same time. Thus, we are able to observe the role of changing weight on speed and emissions.

PROPOSED FUEL CONSUMPTION FUNCTION

Different ship size results in different rates of fuel consumption. In general, the nonlinear relationship between fuel consumption and speed can be represented by a quadratic or a cubic function. According to Barras (2005), fuel consumption is proportional to ship's weight with function $(w+L)^{2/3}$, where w is load and L is the weight of ship including fuel weight. Since fuel consumption of a ship changes with respect to its payload, we propose a new bivariate nonlinear fuel consumption function which depends on both speed (v) and the payload (w) from port k to the next port.

$$f(v_{k,k+1}, w_{k,k+1}) = f(v_{k,k+1})w_{k,k+1}^{2/3} \\ = (0.0036 v_{k,k+1}^2 - 0.1015v_{k,k+1} + 0.8848)w_{k,k+1}^{2/3}$$

In this function, the quadratic part $f(v)=0.0036v^2-0.1015v+0.8848$ shows the relationship between fuel consumption and speed, where the fuel consumption is measured in tones (t), distances are in mile (M), and speed v is in knots (M/h) as in Fagerholt et al. (2010).

□

MATHEMATICAL MODEL OPTIMIZING SHIP SPEED

Our aim is to maximize profit while reducing the fuel consumption and emissions of the ships. Using the nonlinear fuel consumption function, we propose a model for profit maximization on a single shipping route with multiple voyages. Our goal is to observe how profits change according to distances, speed and demand for a company in the long term.

The proposed Model aims to maximize the profit under two different cases for freight rates. In the first case, revenue or freight rate depends on the sailing speed as in the case for time sensitive, i.e., perishable or similar special products. In the second case, we consider time-insensitive products and assume freight rate is independent of the sailing speed. Each case of Model 3 has been analyzed under three different market conditions: high, medium and low demand. Notation, assumptions and models are presented in the following sections.

Model Assumptions

1. Waiting; loading/unloading times at the ports are given and known

2. Fuel consumption is a function of both speed and the payload.
3. Route (sequence of ports to be visited) is given.
4. Crew cost is important factor for profit for ship owner and added on hourly basis.
5. Working schedules or time windows for each port are known and given.
6. The ship operating on a route is capacitated

Notation

Notation	Definition
$k=1,2,\dots,n$	Index for ports on the route
$d_{k,k+1}$	Distance between port k and k+1
$f(v,w)$	Fuel function
$v_{k,k+1}$	Ship's speed from port k to port k+1
$w_{k,k+1}$	Ship's payload from port k to port k+1
t_k	Arrival time to port k
$t_{k,k+1}$	Sailing time from port k to port k+1
e_k	Earliest arrival time at port k
l_k	Latest arrival time at port k
c	Ship's capacity according to ship's size
dem_k	Demand (loading) at port k
sup_k	Supply (unloading) at port k
s_k	Service time at port k
c_r	Crew cost (hourly)
r	Revenue (freight rate)

Freight rate is also changing with respect to product type to be transported. In other words, some products such as fish or frozen foods are perishable and time-sensitive. Therefore their freight rate depends on the trip duration, i.e. freight rate is higher if ship is to sail faster. However, durable products such as iron or grains are not time sensitive and therefore the freight rate is independent of trip duration or sailing speed. For two different product types, we select 8000 TEU capacity container ship.

Proposed Model

$$\text{Maximize } \sum_{k=1,\dots,n-1} r(v_{k,k+1})d_{k,k+1} - \left[\sum_{k=1,\dots,n-1} d_{k,k+1} f(v_{k,k+1}, w_{k,k+1}) + c_r (t_k + \sum_{k=1,\dots,n-1} s_k) \right] \quad (5.1)$$

Subject to ;

$$t_{k+1}v_{k,k+1} - (t_k + s_k)v_{k,k+1} \geq d_{k,k+1}, \quad k = 1,\dots,n-1, \quad (5.2)$$

$$w_{k,k+1} = w_{k-1,k} - dem_k + sup_k \quad k = 1,\dots,n-1, \quad (5.3)$$

$$w_{k,k+1} \leq c \quad k = 1,\dots,n-1, \quad (5.4)$$

$$e_k \leq t_k \leq l_k, \quad k = 2, \dots, n, \quad (5.5)$$

$$v_{min} \leq v_{k, k+1} \leq v_{max} \quad k = 1, \dots, n-1, \quad (5.6)$$

Equation (5.1) is the objective function maximizing profit for company and ship-owners. The profit function is equal to total freight revenue minus the total cost including crew cost, deadweight and fuel consumption costs. $f(v_{k,k+1}, w_{k,k+1})$ is ship's fuel consumption per nautical mile with travel speed $v_{k,k+1}$ and payload $w_{k,k+1}$ for leg from port k to $k+1$. Equation (5.2) represents the relationship between time and speed for each leg. Equation (5.3) is the flow conservation or payload balance constraint. Equation (5.4) ensures that for each leg, ship cannot take more load than its capacity. Equation (5.5) defines earliest and latest time window constraints. Equation (5.6) determines ship's lower and upper speed limits.

NUMERICAL RESULTS

We assume that the ship capacity is 8000 teu and demand is changing according to scenarios (the high, medium and low demand). In the high demand scenario, ship's payload is 6,400 (80% of capacity); in the medium demand scenario ship's payload is 4,800 and finally in the low demand scenario, payload is 3200 TEU. We assume ship is empty at the initial port. Since demand is changing from port to port, we expect speed to change at every leg depending on port time windows as well as loading, un-loading amounts. The ship's speed is increasing when the payload is decreasing. Travel time is changing according to speed. As summarized in Table 6.3, speed and payload condition changes the objective function values in the optimal solution.

For time-sensitive products, revenue is calculated based on the freight rate of 2.525 per ton/mile and for time-insensitive products, freight rate is \$39.3 per mile. The revenue changes between \$30-60 with respect to order and mile.

Table 6.3. Numerical results for objective function of different cases

Objective Function	High Demand Scenario	Medium Demand Scenario	Low Demand Scenario
Freight rate depends on Speed	26,185,028	10,524,944	2,224,600
Freight rate independent of Speed	39,706,000	14,002,711	906,690

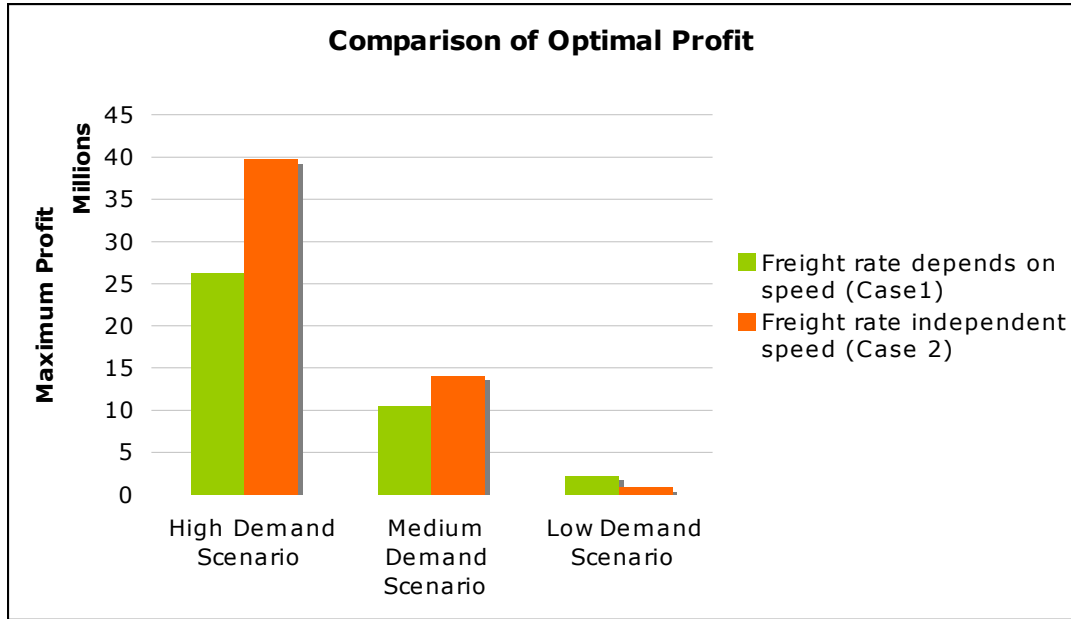


Figure 6.2. Comparison of Optimal Profit

As we expected, profit for time sensitive and time-insensitive products are significantly different. Figure 6.2. shows that when freight rate is independent of speed (as in the case of durable time-insensitive products), profit is higher when there is a high or medium demand. This is mainly because of lower speeds, lower fuel consumptions and higher profit margins. On the other hand when we look the low demand scenario, we can easily see that abundance of available capacity lowers the rated and affects the profit for transporting durable goods. Whereas, urgent need for transporting time-sensitive products such as fish keeps profit relatively higher in Case 1 compared to Case 2. In Figure 6.2, we also observe that market condition or demand has an important role on profits, ship speed and sailing times. When the ship has more payload, the ship does not prefer to sail at high speed in order not to increase its fuel consumption. On the other hand, if the ship travels faster, the ship meets more demand and the ship owner gets more profit. These assumptions are different in different scenarios because supply is changing from port to port. The Table 6.4. shows different demand scenarios and the ship’s optimal speed.

Table 6.4. Numerical results for three demand scenarios and two cases for a 8,000 TEU capacity vessel

Ports	High Demand Scenario (80% full 6,400) Case 1	High Demand Scenario (80% full 6,400) Case 2	Medium Demand Scenario (60% full 4,800) Case 1	Medium Demand Scenario (60% full 4,800) Case 2	Low Demand Scenario (40% full 3,200) Case 1	Low Demand Scenario (40% full 3,200) Case 2
1-2	14,097	14,163	14,761	14,153	14,271	14,176
2-3	17,212	14,378	14,701	14,224	19,620	14,572

3-4	16,884	14,209	15,042	14,255	15,896	14,363
4-5	14,811	14,239	14,816	14,296	16,306	14,222
5-6	14,811	14,269	15,956	14,316	15,479	14,201
6-7	14,706	14,336	15,897	14,344	15,429	14,183
7-8	15,691	14,098	15,597	14,098	14,655	14,097
8-9	14,098	14,098	16,175	14,098	16,529	14,098
9-10	16,750	14,097	14,997	14,098	15,161	14,097
10-11	15,770	14,097	16,205	14,098	16,881	14,098
11-12	15,305	14,097	17,605	14,098	16,728	14,097
12-13	17,891	14,097	21,111	14,098	14,793	14,097
13-14	21,111	14,097	18,481	14,097	24	24

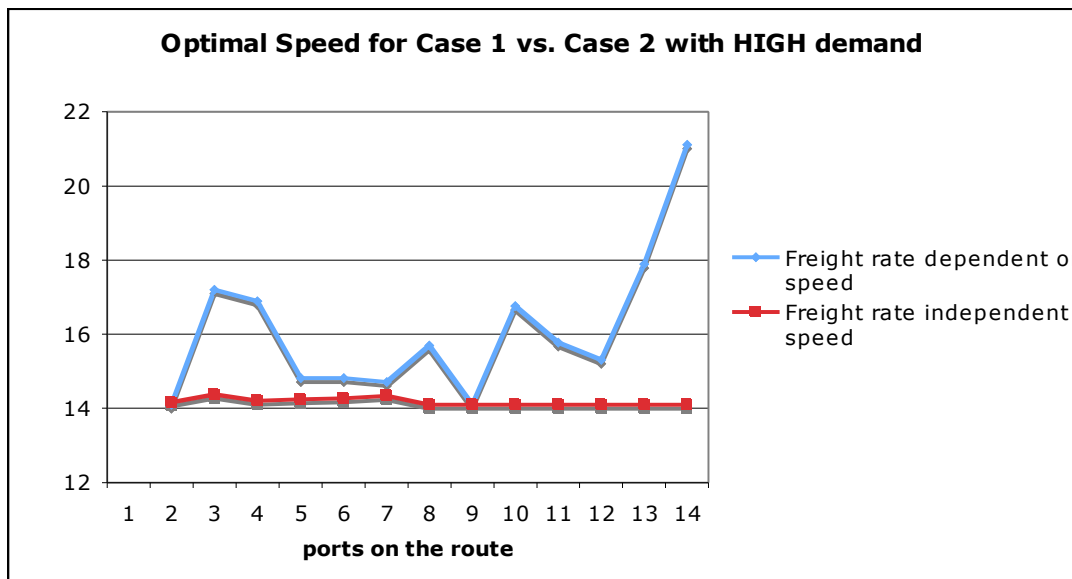


Figure 6.3. Optimal speed for Case 1 and Case 2 in high demand scenario

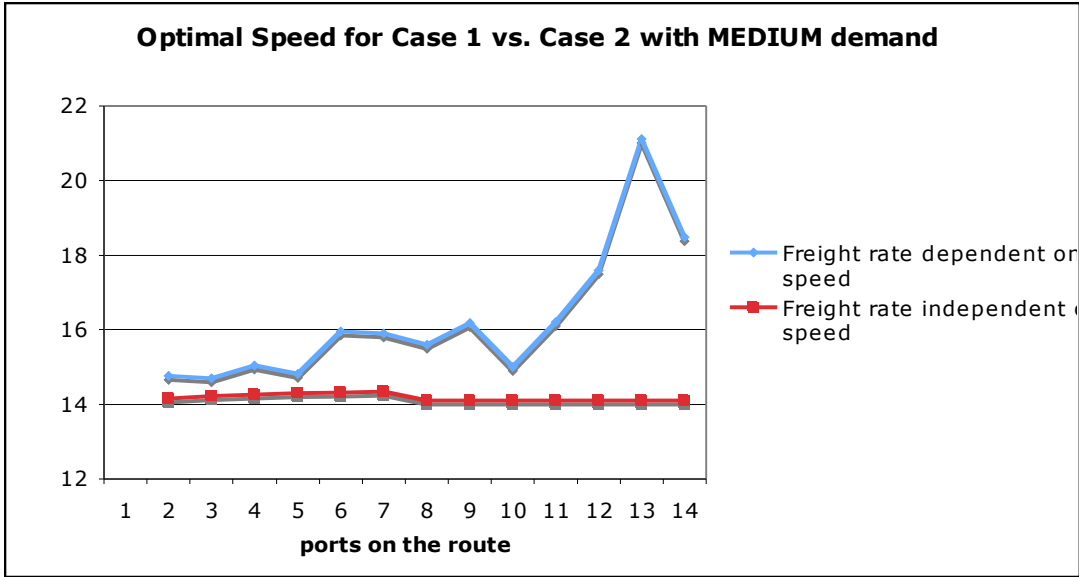


Figure 6.4. Optimal speed for Case 1 and Case 2 in medium demand scenario

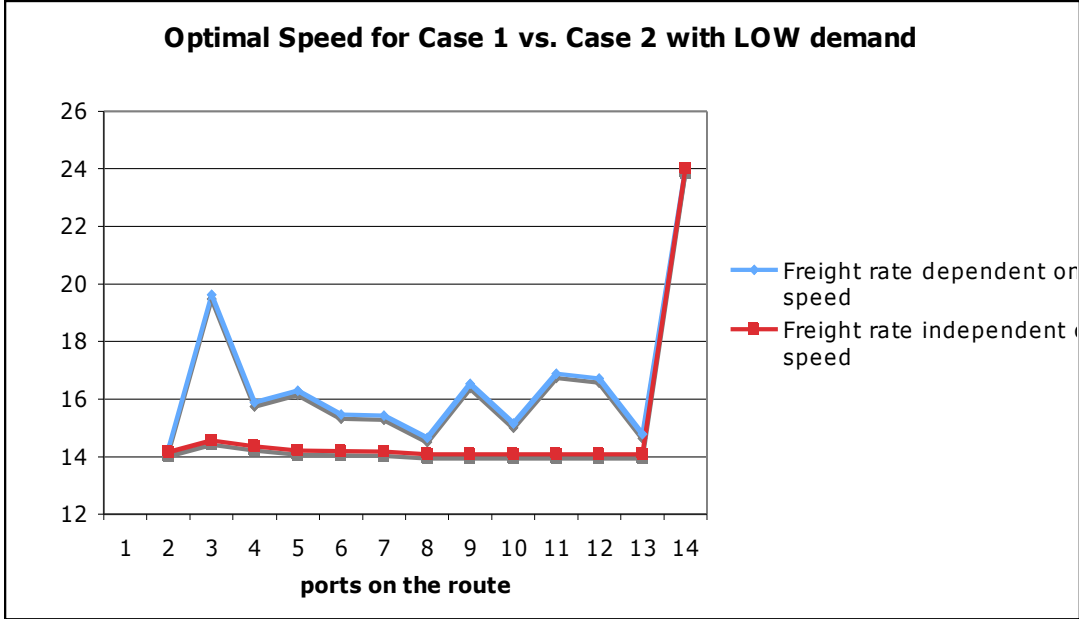


Figure 6.5. Optimal speed for Case 1 and Case 2 in low demand scenario

Figures 6.3, 6.4 and 6.5 show the comparison of optimal speed for time-sensitive (Case 1) and time-insensitive (Case 2) products according to high, medium and low demand scenarios. Although speeds are affected by port to port distances and time windows, time-sensitive products in all scenarios are transported at higher speeds. Results in also indicate that in case of high demand, ships sail at higher speed in order to make more trips and to make more profits. Having expected results justifies the validity of our models.

Table 6.5. Comparison of arrival times in all scenarios and two cases

Ports	High Demand Scenario (80% full 6,400) Case 1	High Demand Scenario (80% full 6,400) Case 2	Medium Demand Scenario (60% full 4,800) Case 1	Medium Demand Scenario (60% full 4,800) Case 2	Low Demand Scenario (40% full 3,200) Case 1	Low Demand Scenario (40% full 3,200) Case 2
1-2	1.5	1.5	1.4	1.5	1.4	1.4
2-3	9	9	9	9.4	9	9.2
3-4	11	11.2	11.4	11.8	11.1	11.6
4-5	21.2	21.3	21.6	22.4	20.4	22.2
5-6	32	32	32	32.4	32	32.3
6-7	38.4	37.4	37.9	39	38.1	39
7-8	50	48.3	49.6	51.9	50.5	51.9
8-9	51.5	49.8	50.9	53.4	51.8	53.4
9-10	58.2	56.8	58.4	61.4	59.2	61.4
10-11	60.4	59	60.5	63.9	61.3	63.9
11-12	70.3	69.1	69.1	74.6	70.3	74.6
12-13	78.3	78.4	75.9	84.7	80	84.7
13-14	82.8	83.8	81	91.4	83.9	88.7

Table 6.5. shows the optimal arrival times to the ports in both cases and all three scenarios. We can conclude that ship’s arrival times are earlier in Case 1 (time sensitive products) compared to arrival times in Case 2 (time insensitive products). Note that arrival times are also affected by type of the product, market condition and speed as we expected.

In conclusion; ship tries to catch up time window for every voyage and when the ship’s voyages speed fast, freight rate will increase. We can see that the speed is affected by payload and revenue; payload is affected by supply and demand. Time window is changing according to the speed and the emissions depending on the entire fuel consumption.

CONCLUSION AND FUTURE WORK

Maritime transportation is affected by optimizing the speed along the route. When fuel consumption reduces, it helps to reduce environmental emissions. Companies want to improve their profit and they constitute time windows and they calculate optimal speed for cost. Thus, while

the company's profit margin increases and sensitivity to environmental issues create a competitive edge in developing world.

As a future work, proposed models can be implemented with real data collected from a liner company. After the real life implementation, numerical results can be compared to existing results. Also, Model formulation can be improved by incorporating randomness in demand values. Finally, a new algorithm to nonlinear optimization problems can be developed as a more theoretical study.

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What Should Be Included in Business Statistics to Prepare Students for the World of Data-driven Analytics?

Session chair: Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Presenters and Panelists:

Hope Baker, Kennesaw State University, hbaker@kennesaw.edu

Joan Donohue, University of South Carolina, donohue@moore.sc.edu

Tracy Rishel, The Citadel, trishel@citadel.edu

Wilma Andrews, Virginia Commonwealth University, wandrews@vcu.edu

Abstract: Business statistics should include more than covering a set of topics from a textbook. Students should also develop some skills and acquire knowledge of selected data analysis tools. Panelists will lead an open discussion of topics, analysis tools and skills that should be included in business statistics to enable students to function effectively in a world that relies on data-driven decision making.

Session Description:

This session will primarily be an open forum on the content of introductory business statistics for today's students. The panelists come with a wide variety of experiences and will help set the stage for an open discussion by expressing their views on a few key things to be discussed. For each item they will give their reasons why they think the item should be omitted or included in a contemporary introductory business statistics class. Once they have made their opening remarks the floor will be opened for a moderated discussion among the session attendees.

To make value judgments among several options one must establish some criteria for making the decisions. The primary criterion will be to determine what will best prepare business students for their future. With the increase in the quantity of data that are available, their future will certainly involve using data to provide valuable information for making business decisions. Obtaining value from data in today's world requires the use of computational tools and other skills such as teamwork and communication ability. For a statistics class a student must learn what implications the variation in the data values have on decision making. However, should the entire focus of the class be on what has traditionally been in a statistics class or should the work in the course strive to develop other skills beyond the typical analysis skills?

The goal is to encourage those in attendance to think seriously about what should be in the introductory statistics class. So often the content of a course is decided by what the faculty knows best and feels the most comfortable teaching but this content may not provide the most beneficial knowledge and capabilities for the students in today's business environment with an emphasis on data-driven decision making.

At the end of the session our hope would be to have developed recommendations or guidelines relative to three categories of course content:

1. typical textbook topics,
2. data analysis and computational tools and
3. other skills.

A Plan, Do, Check, Act (PDCA) Approach to Improve Team Assignments Using a Web-based Tool.

Shona Morgan

Department of Management

North Carolina A&T State University

1601 East Market Street, Greensboro, NC 27411

Alice Stewart

Department of Management

North Carolina A&T State University

1601 East Market Street, Greensboro, NC 27411

ABSTRACT

While many business schools emphasize the development of teams skills as part of their learning goals, there is no doubt that the *development* of team skills among business students (both undergraduate and graduate) is one of the most difficult learning goals to achieve (Feichtner & Davis, 1985). We combine the well-known continuous improvement framework of Deming's (1950) Wheel or the *plan-do-check-act* (PDCA) cycle with a more recently developed tool for team assessment, the Comprehensive Assessment of Team Member Effectiveness (CATME), to provide a template for systematic pedagogical improvement in undergraduate team skills. We first introduce the CATME tool and its capabilities. Next we demonstrate how faculty can use the PDCA cycle to create a thorough CATME team evaluation process to thoughtfully assess the efficacy of their teamwork assignments, and offer demonstrations of how an

evaluation of CATME data can indicate improvements about the structure of team assignments in business courses.

INTEGRATING PROJECT MANAGEMENT PRINCIPLES WITH SYSTEMS DEVELOPMENT METHODOLOGIES: PROPOSING AN EXPERIENTIAL PEER-MANAGED LEARNING MODEL FOR MAXIMIZING STUDENT LEARNING

A. James Wynne, Department of Information Systems, School of Business, Virginia, Commonwealth University, Richmond VA 23220, 804-828-3182, ajwynne@vcu.edu

Chandrasekhar Challa, College of Business, Longwood University, Farmville VA 23909, 434-395-2377, challacd@longwood.edu

Elena Olson, Department of Information Systems, School of Business, Virginia Commonwealth University, Richmond VA 23220, 804-828-7138, eipopel@vcu.edu

ABSTRACT

The purpose of this research is to develop a model for empirically testing the value of collaborating learning processes in systems development courses with those of independent information systems project management courses, using a peer-managed learning approach. The proposed research model is designed to study three student cohorts treated differently to determine the approach that maximizes the learning experience of the students learning systems development and IT project management. Students enrolled in undergraduate IT project management classes will be organized into small project teams. These teams will be assigned the task of managing systems development project teams employing two different peer-managed approaches. IT project management class teams assigned to systems development class teams are given the responsibility for the management of the semester project case with the ultimate goal of encouraging team members to work together in producing quality deliverables that meet all the assignment rubrics within prescribed milestones.

The research design will include team-to-team interaction treatment approaches defined as 1) face-to-face, and 2) virtual. The control test group will not include peer-management of the systems development teams from IT project management class teams. Quality measurement will be determined by the instructor for direct performance evaluation consistency. A validated end-of-semester survey instrument will be administered to measure the value as perceived by students.

BACKGROUND

Courses that require the integration of knowledge, technical skill sets, specialized techniques and tools typically use a combination of in-classroom instruction reinforced with experiential exercises that require the application of the knowledge, skills, and tools that have been introduced via textbook readings, supplemental materials, and classroom discussions. Characteristically, courses such as the systems analysis and design, and IT project management use a pedagogy that includes case studies which present a problem or business opportunity that provides a vehicle to reinforce the fundamental principles of theory from each of the content

areas through the application of relevant tools and techniques in the discipline. In addition, students form teams that begin as a work groups initially, with the hope that by semester's end they mature into teams that work together in a collegial and productive mode, sharing a common set of expectations and work ethics leading to higher-level learning.

Project management provides the management template for organizing, planning, executing and closing out projects. These processes are based on a methodology that structures the work necessary to deliver an end result that meets the expectations of the organization's stakeholders. A technique to facilitate greater team collaboration and efficient team interactions is effective communication. A diverse set of students is brought together as a work group and is expected to form a unified team within a short period of time. To facilitate this unifying process, the team is usually assigned the task of creating a team charter that articulates the team's governance by stipulating each team member's skill sets that they bring to the team, how assignment responsibilities are assigned, obligatory deliverables, and acceptable conduct, and accountability for working together as a team. Included in the team charter are specific consequences for which every team member must agree. These consequences may result in being 'fired' if so voted by the majority of the team membership.

One of the first upper-division courses for Information Systems majors is the Systems Analysis and Design course. These students have not experienced group/team work to any great extent as until they reach the upper division coursework in the major. The foundation introductory courses are typically held in large auditorium settings and lend themselves to individual-based projects. The lack of experience working in teams of four or more leaves students ill prepared for courses emphasizing true team collaborative effort. This lack of experience typically creates a sense of insecurity, as leadership of the team has not been established either formally, or informally. To overcome this insecurity and potentially being misdirected, teams formed from the IT Project Management class students would manage the systems analysis and design student teams. This approach would relieve the inexperienced systems analysis students of the burden to manage their project assignments, and allow them to concentrate on applying learned classroom theory to real-world applications. Concurrently, the upper-classmen will gain a greater understanding of IT project management, applying the principles, tools and techniques they are learning through classroom instruction (whether face-to-face, or virtual) in an experiential setting.

This proposed model of maximizing student learning through peer-managed team projects proffers a set of hypotheses for determining if the use of a peer-managed project team approach provides a greater level of learning for the systems development student teams as well as the project management students. In a longitudinal study, an extension of this research proposes that an evolutionary value-added outcome will better prepare information students for the real-world team work experiences they will face upon graduation.

Peer-Led Team Learning (PLTL)

Pedagogical research suggests that Peer Led Team Learning (PLTL) is a technique that has been used widely to enhance learning in a number of disciplines. Additionally, in most entry level university courses involving STEM (science, technology, engineering, mathematics) subjects, students enrolled in classes that have a laboratory component seem to perform far better than

students who do not enroll in a class that has a laboratory component which does not provide students the ability to apply what they are learning in an experiential setting. For example, when students in one biology class were introduced to the **Peer-Led Team-Learning (PLTL)** instructional approach, those biology students who participated in **PLTL** averaged at least one letter grade higher than those who did not. This difference was statistically significant, and the **PLTL** workshops almost entirely closed the achievement gap in lecture exam and final grades for students who did not take the lab. [13]

In another study, it was also found that PLTL has a positive impact on improving critical thinking in some science courses, and that it results in increased grade performance and retention in science and math courses, particularly for females. However, math students did not show significant increases in critical thinking, although, it is premature to conclude that PLTL does not promote critical thinking in math. [9]

Studies have also shown that the introduction of PLTL into the learning framework has had an affect in the drop-fail-withdrawal (DFW) rate. In one study conducted at UT Dallas it was found that using PLTL in the chemistry class had an 18% drop in DFW rate from the proceeding five-year average. [1]

Further studies have also confirmed that student groups led by in-class peer leaders (students currently enrolled in the same class) and student groups led by students who have previously done well in the course (referred to as standard peer leaders) are equally effective in the student learning although their mode of implementation may be different. [10]

Studies have also confirmed that students participating in the PLTL-based learning community program in an introductory applied statistics course acquired significantly greater content mastering statistics when compared to non-participating peers. [3] A variation of PLTL-based learning is the cyber Peer Led Team Learning (cPLTL) model, which provides **PLTL** to the broader undergraduate population in STEM disciplines who do not have the opportunity to participate in **peer-led** workshops due to inflexible work or family schedules, or because their institutions lack the physical space to provide workshops on-campus. [5]

Another variant of PLTL is cooperative learning. This learning pedagogy is also called active learning. When students work in teams, it not only improves their understanding of the coursework, but also prepares them for the workplace where organizations embrace the team-based approach to achieve a desired result. [2]

A Peer-Led Team Learning (PLTL) program was implemented in a first-year undergraduate Anatomy and Physiology course sequence to examine the student perception of the program and determine the effect of PLTL on student performance. Students shared that several dimensions of employing PLTL provided moderate, good, or great assistance in their overall learning of the course content by promoting discussion and collaboration with other students and engaging them in active learning.

The results of the PLTL programs supported the hypothesis of increased student perception of learning and supported an improvement in student performance with certain content in the course. [4]

The PLTL approach to learning also promotes effective student engagement in out-of-class activities between classes. A study used a virtual learning environment (VLE) known as Wolverhampton Online Learning Framework (WOLF) to encourage collaborative working within learning sets. The main objective was to investigate the potential for improving communications and mutual support between students and also to encourage students to make links between taught sessions. The feedback when collected in three ways, including focus groups, module feedback forms and a short questionnaire about the use of the VLE, found that overall, the students' feedback was positive and their comments generally supported acquiring a number of skills including, using technology, group working and presentations. In addition to this, the overall pass rate for the module was higher and the average student grade also increased. [7]

Another study of PLTL was implemented in a mathematics course in an engineering and computer science program. Here an analysis of the student's learning outcomes in the program also suggests that increased participation in the PLTL groups correlates to better course performance. [8]

In a related peer-to-peer learning study via software video conferencing the examination of the impact of simple, live videoconferencing in an online peer-learning context was studied. The

Study also provides a formal measure of how learners can provide "symmetrical" support for each other in a live non-formal context, even without a formal set of lectures and seminars. [11]

All these PLTL-related studies have demonstrated that when such a learning environment is created, students benefit in almost all circumstances. Some of the major benefits include:

1. On average more than a letter grade higher than those who did not participate,
2. positive impact on critical thinking,
3. drop in DFW rate,
4. acquired significantly greater content mastery,
5. experienced active learning to not only improve the students' understanding of the coursework but also prepare them for the workplace,
6. increased student performance,
7. gaining a number of skills including the use technology, group working and presentations, and
8. correlates to better course performance.

Cyber Peer Led Team Learning (cPLTL)

Building on the success of PLTL a new study was conducted to compare the outcomes of student's performance using PLTL to student's performance in an online PLTL environment. Basically, PLTL and cPLTL are the same except the setting in cPLTL is a synchronous online setting rather than face-to-face. Using a blend of these two models, a hybrid approach to active student learning methodology, was conceptualized in a study at a university's chemistry course where cPLTL students attended the same face-to-face lecture as their classmates, but elected to participate in synchronous online workshops rather than face-to-face workshops. [6]

Taking the basic premise of PLTL, another study was conducted to determine if PLTL workshops used in a general chemistry course could be transitionally used in a synchronous online setting, and produce comparable student outcomes. [12]

Proposed Pedagogical Study—Improved Experiential Peer-Managed Learning Model for Maximizing Student Learning

The purpose of this research is to develop a conceptual model to investigate the validity of two formats of PLTL:

1. conventional face-to-face learning; and
2. cPLTL, an online learning environment.

The two treatments would be tested and compared to the control group where no PLTL introduced to determine if there are any significant differences in student learning. The proposed set of hypotheses include determining if the use of a peer-managed project team approach provides a greater learning experience for the systems development student teams.

In a longitudinal study, an extension of this research proposes that an evolutionary value-added outcome will better prepare information students for the real-world team-based experiences that require enhanced social skills that are not traditionally included in technology-based courses, but they will be significant criteria for successfully adjusting to the diversity of organizational cultures.

More specifically, the research study will address the following:

1. Building an experimental design model that will contain three interdisciplinary student groups with different types of peer-management interactions as follows:
 - A. Cohort I (control group) – no peer-management interactions
 - B. Cohort II – in-class peer-management interactions
 - C. Cohort II – virtual peer-management interactions

Each cohort will be evaluated by comparing the results of the direct assessment of individual student learning outcomes, and the indirect assessment using a student satisfaction survey. An independent evaluation of quality and quantity of student interactions within their groups will be determined by using team members 'edge' analysis software and/or tracking forum participation interactions.

The following hypotheses will be tested:

Hypothesis 0: The groups with the peer-management interactions produce better results than the control group (traditional, non peer-managed team interactions).

Hypothesis 1: The group with in-class peer-management interactions performs better than the group with virtual peer-management interactions.

METHODOLOGY

As a base for conducting our experiment, two undergraduate level courses were chosen: INFO361 System Analysis and Design, and INFO461 Project Management. The INFO361 course introduces students to system analysis and design principles with further application of the learned theory in the analysis and design methodology to a guided case study for developing an information system within an organization. INFO461 course focuses on IT project management fundamentals. The course requires that students demonstrate their skills by managing an IT systems development project. INFO361 is a required prerequisite to the INFO461 course, so the students are very familiar with the concepts, tools and techniques learned in the course prior to their enrollment in the IT project management course. Traditionally, both courses are taught separately with in class lecture and outside-of-classroom project assignments. In our experimental model, the students of both INFO361 and INFO461 courses will be equally divided into three separate cohorts with the course instructional design difference as follow.

- **Cohort I** (control group with traditional course delivery): The students of INFO361 and INFO461 courses will work in separate classrooms with no interactions with each other. Each course will meet twice a week for in-class lecture and will work on final projects individually outside of class. The course instructors will monitor and manage the progress on the final project assignments.
- **Cohort II**: The students of INFO361 and INFO461 courses will meet once a week in separate classrooms for in-class lecture, and once a week in the same classroom to work collaboratively on their project assignments. The merged cohort of students from both courses will be divided into small groups with the ratio of INFO361 to INFO461 students in each group as 4:3. The main objective for the project assignments for the INFO461 students will be to monitor and peer-manage the project assignments of the INFO361 students. The course instructors will monitor and manage the progress of the INFO461 students on their final projects. In addition, the course instructors will register and evaluate the student interactions within the small teams.
- **Cohort III**: The students of INFO361 and INFO461 courses will meet once a week in separate classrooms for in-class lecture, and once a week will work virtually on their projects. Similar to the Cohort II, small groups of the students from both courses will be formed with the ratio of INFO361 to INFO461 students in each group as 4:3. As in Cohort II, the INFO461 all project assignments will involve monitoring and peer-management of the INFO361 student project assignments. The course instructors' role will be to monitor and manage the progress of the INFO461 students on their final projects, as well as register and evaluate the virtual student interactions within the small teams.

Direct assessment will be conducted using an evaluation instrument and will include the comparison of the final exam results for each model treatments separately; and the analysis of the student course experiences data as collected via conducting an in-depth Student Satisfaction Survey. Finally, we will evaluate and compare the student interactions within the small groups.

SUMMARY

This paper represents only the first step in the research agenda for this approach to create a learning experience that closely mirrors the experiences that students will be faced with during their professional careers throughout life. In sharing the proposed model for enhancing the student learning outcomes through an approach that includes the oversight of the student teams by peer-student teams, the authors are hoping that session participants will provide additional insight into the research design with the intent for validating the model to ensure the integrity and value of the model for use in other courses where peer-managed teams can be employed. Feedback from the reviewers and session participants will be used in any revisions to the research model with considerations for extending the most promising model to other courses which involve peer-to-peer collaboration where the effectiveness of the final product produced by the team reflects in-depth knowledge and understanding of a business discipline that exceeds the average results as seen from traditional pedagogical approaches.

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A Proposal: The Use of an Integrated Learning System in Intermediate Accounting

Catherine L. Staples, PhD, CPA

Randolph-Macon College

cstaples@rmc.edu

INTRODUCTION

Ask any accounting major and he or she will agree that intermediate accounting is hard! In fact, it is probably considered one of the hardest courses an accounting major has to take. What makes it so difficult? For most students, it is the large number of complicated topics that must be covered in intermediate accounting. In addition, for many students, their foundation of introductory accounting is very weak. They don't remember the basic concepts of accounting learned previously so they are not ready for the complexity of intermediate accounting. This is not an unusual situation—most instructors of intermediate accounting complain about the lack of knowledge of basic accounting concepts that students have. Even intermediate textbooks take this into account and include several chapters designed to review the basic accounting cycle, the balance sheet and the income statement. Unfortunately, the level of knowledge about basic accounting is not consistent across all students. Some students remember very little while others, in the same class, may pick up on the topics quickly. This disparity makes it difficult for an instructor to plan how to teach. This study discusses one approach to reducing the difficulty in teaching students with different skill levels: an integrated learning system.

The remainder of this proposal will provide a brief historical perspective on the use of programmed learning and then will discuss what an integrated learning system is. Finally, one integrated learning system, in particular, ALEKS, and its integration into an intermediate accounting class will be discussed.

PROGRAMMED LEARNING AND B.F. SKINNER

Programmed learning was first introduced in the 1950s by the behavioral psychologist B.F. Skinner. He believed that learning was enhanced when five educational principles were followed. Those principles stated that students should (1) be active in the learning process and (2) receive immediate feedback as to their performance. In addition, learners should be examined (3) on small chunks of material so that they feel they are making progress but they (4) should be allowed to progress through the material at an individual pace. Finally, he believed that (5) learners should be able to evaluate the instructional program in an effort to improve its effectiveness. (ELearning Industry) As a result, Skinner developed a system of learning which allowed a student to learn basic concepts such as spelling, arithmetic and reading through repetition. Using a specially designed set of materials organized in a logical and tested sequence, students would answer a series of questions and progress only if they answered correctly. This approach allows

for the different abilities and needs of each student. Those that have mastered the material more quickly are allowed to progress to new concepts sooner while those requiring more practice are provided it. (Programmed Learning)

INTEGRATED LEARNING SYSTEMS VERSUS ON-LINE HOMEWORK SYSTEMS

The use of computer-based learning systems has been increasing over the last few years in a variety of disciplines. Like B.F. Skinner's programmed learning process, these learning systems allow students to focus their attention on a single topic, usually within a module, and receive individualized feedback on their progress at understanding that topic. The intelligent systems identify rules and relationships of functional problems which allow the system to analyze a student's reasoning throughout the learning process. Certain topics in accounting lend themselves beautifully to the algorithmic nature of the feedback system. In particular, the basic accounting cycle, including debits, credits, and journal entries, is tailor-made for such a learning process.

Several studies have focused on the benefits derived from the use of artificial intelligence in the study of the accounting cycle. The University of Melbourne's *MarlinaLS* system, "an on-line system developed specifically to enhance reciprocal learning," and its impact on test scores was discussed by Potter and Johnston (2006). *MarlinaLS* provided students with on-line tutorials for a variety of topics within the accounting cycle. Part of the tutorials allowed students to ask questions in order to get fast, on-line assistance. Once a student felt comfortable with the topic, he or she would then take an assessment of their understanding of the material. Over a two-year period, 1116 second-year students utilized this intelligent learning system in a *Cost Management* class. The researchers compared the amount of time a student spent using the system with the grade received on the final exam of the course and found that the better-performing students had spent more time using the tutorial system than the weaker students.

Johnson, Phillips and Chase (2009) found that the use of an electronic tutoring system in the completion of journalizing assignments resulted in improved test performance. Students in two managerial accounting classes were given an in-class assignment to complete 28 transactions. Students in one class were allowed to access only their textbook during the assignment while the other students were provided with an on-line tutorial system as their reference tool. The results of a pre-test and a post-test were compared and suggest that the test scores of students utilizing the tutoring system improved significantly more than those of the textbook group.

On-line homework systems also provide feedback to students; however, the processes used by students to complete the assignments are not monitored or evaluated. Students, as long as they get the correct answer, are allowed to continue to the next problem. Computer-based learning systems focus on how a student gets to the answer and, even if the correct answer is provided, the student may have to continue to learn the material. Phillips and Johnson (2011) compared the use of intelligent tutoring systems with on-line homework systems and found that the performance of students on transaction analysis assignments improved significantly when an on-line learning system was part of the learning process. In an effort to minimize the impact

differences in students might have on the results, all of the students utilized both the on-line homework system and the intelligent tutoring systems.

IMPLEMENTATION OF AN INTEGRATED LEARNING SYSTEM INTO INTERMEDIATE ACCOUNTING

Following years of frustration with the varying levels of student understanding of basic accounting concepts in Intermediate Accounting I, the author decided that something had to change. As is common in most intermediate accounting classes, considerable time was being spent on reinforcing and reestablishing the foundation topics. Unfortunately, that meant less time was available to talk about the more complex, more relevant, accounting topics. It was further noted that some students seemed to need less time for the reinforcing activities than others. At times, these students seemed bored with class discussions. Research into possible alternative teaching approaches unearthed several options each of which involved some form of integrated, self-paced learning systems, including McGraw Hill's ALEKS and Wiley's WileyPlus with ORION. Both of these systems allow students to learn accounting concepts at their own pace and be an active participant in the learning process. After careful consideration, the author chose to use ALEKS since it has several variations of course offerings, ranging from small courses just focused on the accounting cycle to longer courses that cover material on topics such as bonds, investments, and revenue recognition. In addition, implementation was fairly straightforward. In addition, it was decided that ALEKS would be used over the course of both Intermediate I and Intermediate II in order to strengthen the basic material as well as reinforce the new material.

Once this decision was made, the curriculum was divided into a series of modules, each one focused on a specific overall topic, such as the accounting cycle or the balance sheet. Individual topics were then allocated to each module. Due to the complexity of some of the modules, the number of topics varied between modules. For instance, the accounting cycle module had 39 individual topics while the revenue recognition module had only three. Students were given deadlines for each objective which aligned with the class syllabus as best as possible. Since the ALEKS material was basic level, it was considered acceptable if the students were required to complete the module before completing class discussions. As students completed the modules, both they and the author could see how they were progressing and whether they had "mastered" the material.

As predicted, students progressed at their own pace throughout the modules, with some mastering the material at a much faster pace than others. If a student answered incorrectly, they were required to answer another, very similar, question. If they were not sure of how to answer correctly, they could access an explanation of the topic. In order to ensure the assignment was taken seriously, grades were given for each of the modules. Grading, however, was based on completion, not level or speed of mastery. If a student completed the entire module within the time constraints, they received 100 percent of the assigned points. The total grade assigned to ALEKS was approximately 10% of their total class grade so it was an incentive to complete the

modules. In addition, completion of the module ensured some level of understanding of the material.

Initially, there were some hiccups with the implementation of the system. At first, students complained about the time it took to complete a module but the more they used the system, the more proficient they became with the mechanics. By the end of Intermediate Accounting I, students were commenting on how much they liked the system and its ability to explain the basic topics. By the end of Intermediate Accounting II, students were recommending its use in future intermediate classes. They appreciated the repetitive nature of the program, especially if they did not master the material as quickly as they would have liked.

PROPOSED RESEARCH QUESTION AND METHODS

This proposed research plans to look at whether or not the use of ALEKS was effective. Did students utilizing ALEKS actually improve compared to students in previous years that simply did homework problems and projects? Since ALEKS has only been used in one full year of Intermediate Accounting, statistical analysis will be limited. Comparisons of class grades, mid-term exam grades and final exam grades between the students who used ALEKS versus those who did not will be analyzed.

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INVESTIGATING THE IMPACT OF MUSIC DURING TOURS IN CHINA'S SETTING

Han Yan, Wuxi No. 1 High School, 98 Yun He Dong Lu, Wuxi, China 214031, (86)131-8270-8588, 2078828969@qq.com

Yajiong Xue, College of Business, East Carolina University, 252-737-1443, xuey@ecu.edu
Huigang Liang, College of Business, East Carolina University, 252-737-1462, liangh@ecu.edu

ABSTRACT

This research investigates how music playing can influence Chinese tourists' tour satisfaction and stress. An experiment was conducted to test our hypotheses. We recruited 80 tourists and randomly assigned them into two groups. During their trip, the music group was exposed to music while the no-music group was not. At the end of the tour, their tour satisfaction and stress were measured by self-report questionnaires. It was found that listening to music significantly improved tour satisfaction, but did not significantly reduce stress. The findings of this study has important implications for both research and practice in tourism.

Introduction

With the booming of China's economy and the substantial increase in Chinese people's personal income, tourism in China has greatly expanded in recent years. China has become one of the world's top inbound and outbound tourist markets. According to the World Tourism Organization, in 2020, China will become the largest tourist country and among the largest for overseas travel [1].

Many people view taking pleasure trips outside their usual environment as an integral feature of their life [2]. Taking tours is found to improve individual's mental and physical health [3] because tourists have more opportunities to detach from their regular environment, to experience new things, and to arrange things they want to do during vacations [4]. Yet, in reality, there are many factors that can impede the realization of these benefits of taking tours. Delays of services [5], crowding [6], and tight schedules all could reduce consumers' satisfaction. In the tourism industry, those factors could also affect travelers' mood during trips. Many cases have been reported regarding travelers' bad moods such as frustration and anger during trips [7].

Music has been identified as a relaxation aid [8]. Listening to music has the potential to improve people's perception of satisfaction [9] and reduce stress [10]. Yet, there are inconsistencies regarding the impact of music within the extant literature [10]. According to some review studies conducted by Evans [11], Nilsson [12], and Pelletier [13], the inconsistencies may be due to environment, population characteristics, and other moderating variables.

This study intends to study the impact of music on Chinese travelers' perception of tour satisfaction and stress. This study makes two important contributions to the existing literature. First, it examines the impact of music in the tourism setting. To date, no similar research in this setting has been conducted. Second, the majority of prior research focused on the impact of music was conducted in Western countries. This paper is one of the first attempts to investigate how music influences tourists in China.

Method

Dependent Variables

This study examines the effect of music on two dependent variables – tour satisfaction and stress. Tour satisfaction is defined as the degree to which an individual favorably judges the overall quality of a given tour [14]. Psychologists suggest to ask individuals how they feel to measure their satisfaction [15]. In our study, tour satisfaction was self-reported by the respondents. We adapted Diener et al's 5-item satisfaction with life scale [16] to measure tour satisfaction. Examples of items include "In most ways this tour is close to ideal" and "The conditions of this tour are excellent."

Stress incurs emotions such as anxiety, fear, or tension [13]. In our study, stress was measured using the 8-item scale developed by HeartMath Institute [17]. Participants were asked to evaluate their stress based on 8 statements such as "I feel tense and anxious inside," "I feel resentful that I have not been treated well," and "I feel pessimistic that things will turn out for the worst."

Both measures were evaluated by using a 5-point Likert scale. The respondents were asked to report their agreement with each item by selecting: "Strongly Disagree," "Disagree," "Neutral," "Agree," or "Strongly Agree."

Hypotheses

In the present study, we hypothesize that,

H1. Traveler's tour satisfaction in music playing group is higher than in non-music playing group.

H2. Traveler's stress level in music playing group is lower than in non-music playing group.

Participants

Our study was conducted during a one-day tour with the help from a travel agency. First, we recruited 80 travelers. We randomly assigned them into two groups with 40 travelers in each group. The two groups took two buses of exactly the same model. Each bus had a driver and a tour guide. The two bus drivers and tour guides were trained with the same instructions before the study. These two groups took the same tour to an attraction place which needed around 1.5 hours' driving from the starting city. During the 1.5 hour drive to the destination, music was played on one bus and no music on the other bus. The same music was also played during their return trip.

The music played on the first bus was carefully selected. We included a variety of different music genres into the play list. After consulting three professional musicians, the play list was finalized which included 13 pieces. As Elliott et al [10] suggested, we considered tempo, melody, and harmony. The pieces included different musical instruments such as piano and violin, and different tempos such as allegro and largo. When the travelers were first seated in the bus, they were a little bit excited, and three brisk pieces were played. In the middle of the trip,

seven soothing pieces with slower tempo were played to help the tourists relax. About 15 minutes before arriving at the destination, three lively pieces were played to energize the tourists.

The questionnaires were handed to all of the tourists at the end of their return trip. They were asked to answer each question truthfully based on their personal experiences and feelings. The participants were informed that all of the data will be kept anonymously.

Analysis and Results:

All tourists finished the survey. After removing three incomplete surveys, 77 completed surveys were used in our analysis. Among the 77 survey respondents, 38 were male and 39 were female.

SPSS 22 was used to analyze the data. To test the reliability of the instruments, we calculated Cronbach’s alpha values. The Cronbach’s alpha values for tour satisfaction and stress were .827 and .870, respectively. Both are greater than the preferable cutoff value of .70 [18], indicating a high degree of scale internal consistency.

ANOVA analysis was applied to test the differences between the two groups. Table 1 presents the means and standard deviations of the 5 items of tour satisfaction and 8 items of stress separately. The results show the mean of tour satisfaction of the music group is significantly greater than the mean of the no-music group. Although the mean of stress of the music group is lower than the mean of the no-music group, the difference is not statistically significant (except the 8th item).

Age was not found significant between the two groups, which indicates the division of the age distribution between these two groups is similar. This confirms that the tourists had been randomly assigned into the two groups.

Table 1: ANOVA Analysis Results

	Group 1: Music group Mean (SD) N=38	Group 2: No music group Mean (SD) N=39	F	Sig.
TS1	3.737 (.76)	2.795 (.92)	23.840	.000
TS2	3.342 (.85)	2.846 (.81)	6.877	.011
TS3	3.763 (.71)	3.103 (.91)	12.484	.001
TS4	3.737 (.89)	2.744 (1.04)	20.113	.000
TS5	3.158 (1.0)	2.692 (1.03)	4.045	.048
S1	2.132 (.78)	2.205 (.80)	.167	.684
S2	2.237 (.75)	2.538 (.79)	2.947	.090
S3	1.816 (.51)	2.026 (.71)	2.216	.141
S4	1.816 (.56)	2.051 (.56)	3.391	.070
S5	1.947 (.52)	2.000 (.65)	.254	.695
S6	1.737 (.60)	1.949 (.60)	2.377	.127
S7	1.816 (.56)	2.026 (.63)	2.382	.127
S8	1.658 (.53)	1.949 (.56)	5.438	.022
Age	40.342 (13.53)	38.36 (15.56)	.355	.553

Discussion, Limitation, and Conclusion

The results of the present study establish, as hypothesized, a positive relationship between music playing and travelers' perception of tour satisfaction. H1 is supported. This extends the impact of music to the tourism industry. In China, tour guides usually use game playing or jokes to help travelers relax during their trips. Based on this study, tour guides can also use appropriate music playing during tours to improve travelers' satisfaction. Proper use of music have important impact to the travelers.

The music group's stress level is not significantly lower than the non-music group's (except the 8th item), H2 is not supported. This suggests that playing music cannot reduce tourists' stress during trip. The lack of statistical significance could have different explanations. First, the sample size in this study is relatively small, and the small sample size might not provide sufficient power to detect the between-group difference in stress. Second, it could be possible that music mostly influences positive feelings like satisfaction whereas has little impact on negative feelings like stress.

This study has some limitations. First, we did not differentiate between the music pieces in the playlist. In future research, researchers can categorize those music into different categories and evaluate the impact of different music on people's perceptions. Second, the study was conducted in China and all of the participants are Chinese people. Their unique cultural background could have implicit influence on their reaction to music. It would be interesting to study how cultural characteristics affect individual's emotional response to music. Including the cultural aspect will help to extend the generalizability of the music's effects. Third, music was only played for three hours during the short round trip. It may require a longer period of time for tourists to be exposed to music so that the music's effect becomes salient. Future research should take time into account when examining the effect of time and evaluate whether duration of exposure to music is related to outcomes.

In conclusion, this study investigates the impact of music on Chinese people's tour satisfaction and stress level. The findings have implications to both academia and the tour industry.

APPENDIX

Survey instruments:

Tour Satisfaction:

1. In most ways this tour is close to ideal.
2. The conditions of this tour are excellent.
3. I am satisfied with this tour.
4. So far I have gotten the important things I want in this tour.
5. If I could take this tour again, I would change almost nothing

Stress scales:

1. I feel tense and anxious inside.
2. I feel resentful that I have not been treated well.
3. I feel pessimistic that things will turn out for the worst.

4. I feel frustrated about how my life is going right now.
5. I feel angry with people or situations in my life.
6. I feel sad and gloomy in most situations.
7. I feel overwhelmed by even the smallest task.
8. I feel very unhappy and hopeless about my life right now

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Measuring Competitive Balance in NHRA Pro Stock Motorcycle
Clay E. Harshaw, C. Clinton Harshaw, Kyu-soo Chung, Gonzalo Asis Ruiz

Competitive balance is important to all sanctioning bodies of sport. While league based sports can make use of salary caps and drafts to enhance competitive balance among teams, changes to the rules package are implemented to enhance competitive balance in individual sports. The National Hot Rod Association (NHRA) is the largest motorsports sanctioning body in the world. Among its four professional classes is Pro Stock Motorcycle. This study examined the competitive balance effects of changes to the rules package in the NHRA's Pro Stock Motorcycle category for the 2011 through 2013 seasons, in two ways: within season competitive balance and between season competitive balance. This study uses the Adjusted Churn index to examine the within season competitiveness. Between season competitiveness is analyzed using the Lorenz curve and accompanying Gini coefficient for both points and purse. We also investigated the number of competitors participating each season for each event. Our results indicate the changes to the rules package for NHRA Pro Stock Motorcycle for the 2013 season had significant positive effects on competitive balance, but did not have a positive effect on increasing the number of professional competitors. For each measure of competitive balance, we developed a corresponding nonparametric measure of reliability so that the sanctioning body and track managers can better predict, with confidence, the level of competitive balance in a subsequent season, given the current rules package.

TOWARDS AN EFFICIENCY ANALYSIS OF COLLEGIATE ATHLETICS

Mauro Falasca

Department of Marketing & Supply Chain Management
College of Business, East Carolina University
3134 Bate, Greenville, NC 27858-4353
(252) 328-9871, falascam@ecu.edu

John F. Kros

Department of Marketing & Supply Chain Management
College of Business, East Carolina University
3205 Bate, Greenville, NC 27858-4353
(252) 328-6364, krosj@ecu.edu

ABSTRACT

As allegations of non-compliance and out-of-control spending by athletic departments as well as the pressure to win continue to increase, there exists much interest in research on, and debate about, intercollegiate athletics. A number of studies have previously investigated issues related to Title IX compliance, specific aspects of intercollegiate athletics success, and different financial aspects of the athletics 'arms race'. However, no previous studies have attempted to evaluate all three factors simultaneously. This paper discusses the development of an analytical model aimed at measuring how efficient university athletic departments are in terms of the use of resources to achieve intercollegiate athletics success, generate revenue, and provide collegiate athletics opportunities in a way that complies with federal regulations.

INTRODUCTION

Title IX of the United States Education Amendments of 1972 is a federal law which states that “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance” [1]. In terms of Title IX compliance, universities are required to provide playing opportunities at the intercollegiate level for men and women in an equitable way. In 2013, less than 400 (out of more than 2,000) institutions met the law’s proportionality compliance option, which aims to provide participation opportunities substantially proportionate to the ratio of males and females in the student body [2, 3]. An analysis of the law’s scholarship requirements, indicates that more than half of the schools were not in compliance in 2013 [3].

While opportunities and resources have increased for women, evaluating whether Title IX has led to equity in college sports today is complicated by the increased spending that has characterized the current athletics ‘arms race’ [4] [5] [6]. Data collected from over 2,000 higher education institutions in 2013 indicated that athletic department expenditures totaled almost \$15 billion [3]. In the case of the Division I Football Bowl Subdivision (FBS), athletic department expenditures ranged from around \$10 million to nearly \$150 million, with the average Division I FBS institution spending around \$60 million [3]. As a result, the high economic stakes inherent to big-time intercollegiate athletics fuel an extreme pressure to win and can also foster non-compliance [7] [8] [9] [10].

The purpose of this study is to develop a model that simultaneously combines multiple financial aspects of athletic department operations with Title IX compliance requirements. The model is aimed at evaluating the relative performance of athletic departments responsible for managing resources to achieve intercollegiate athletics success, generate revenue, and provide collegiate athletics opportunities in a way that complies with federal regulations.

The rest of the paper is organized as follows: The study begins with a brief overview of the Title IX literature and the field of Data Envelopment Analysis (DEA) which provide theoretical background for this research. The authors then discuss the development of the proposed model before transitioning to the data and the model inputs and outputs sections. In the final two sections, results and conclusions are presented.

TITLE IX

Title IX research has typically focused on qualitative analyses by historians and legal scholars. Brake [11], for example, investigated legal aspects of Title IX requirements using past judicial rulings and policy, while Suggs [12] analyzed the historical impact of Title IX on universities, coaching and athletics administration.

In terms of Title IX analytical research, a study by Stafford [13] used regression to examine relationships between participation and scholarship compliance, while a study by Agthe and Billings [14] found that schools with football programs are less likely to comply with Title IX. Kennedy [15], on the other hand, performed a comparison of schools to analyze participation and

scholarship compliance. In a similar study, the author found that relatively few higher education institutions satisfied the Title IX scholarship criteria while an even smaller number of schools satisfied the participation requirements [16].

DATA ENVELOPMENT ANALYSIS

Since first being introduced by Charnes, Cooper and Rhodes [17], DEA has been widely used to analyze the performance of decision makers in several different areas. For example, DEA has been one of the most commonly used approaches to measure performance in the healthcare industry [18], the education sector [19], the transportation sector [20], as well as the field of sports management [21, 22].

However, to the best of our knowledge, no published studies have used DEA to simultaneously investigate different aspects related to Title IX compliance, intercollegiate athletics success, and the generation of revenues in collegiate athletics.

MODEL

The objective of a DEA model is to estimate the efficiency a decision making unit (DMU) [17]. As shown below, the efficiency of a DMU is measured by comparing the sum of its weighted outputs to the sum of its weighted inputs.

$$e_k = \frac{\sum_{j=1}^t v_j Y_{jk}}{\sum_{i=1}^s u_i X_{ik}} \tag{1}$$

where e represents the efficiency of DMU k . Each DMU has j outputs (Y) generated from i inputs (X) weighted by v_j and u_i , respectively.

In the linear program below, the weights represent the decision variables, while the different inputs and outputs are used as the model parameters.

$$\max \phi \tag{2}$$

subject to

$$\sum_{j=1}^n \lambda_j X_{ij} \leq X_{io} \quad \forall i$$

$$\sum_{j=1}^n \lambda_j Y_{rj} \leq \phi Y_{ro} \quad \forall r$$

$$\sum_{j=1}^n \lambda_j = 1$$

$$\lambda_j \geq 0 \quad \forall j$$

Efficiency scores can be calculated for each DMU by solving the model formulation once for each DMU. In our context, a DEA efficiency score of 1.0 or 100% would indicate that a school has efficiently used their financial resources (i.e., based on the data, there is no evidence to demonstrate that a peer institution can perform better). On the other hand, an efficiency score lower than 1.0 or 100% would suggest that, relative to the institutions included in the analysis, a school is inefficient in its use of the available resources.

The proposed model can thus be used to identify the set of efficient and inefficient higher education institutions.

DATA

Data from Division I FBS universities is used to evaluate the relative efficient use of athletic resources. The data was obtained from three sources: the Directors' Cup website [23], the OPE Equity in Athletics database [3], and the USA Today athletic director salary database [24]. As recommended by Cooper, Seiford and Zhu [25], DMUs with missing values were not included in the analysis.

MODEL INPUTS AND OUTPUTS

One key advantage of DEA over other alternative techniques is that DEA can easily accommodate multiple inputs and multiple outputs [26]. The proposed DEA model incorporates four output and five input variables.

It is important to include a large enough number of DMUs in each group in order to develop models with good discriminatory power. In this respect, researchers have proposed a series of rules of thumb related to the minimum number of observations required by a DEA model. Dyson, Allen, Camanho, Podinovski, Sarrico and Shale [27], for example, suggest including at least twice the number of output variables times the number of input measures. Since our model

includes five input variables and four output variables, the minimum required number of observations is satisfied since over 100 institutions were included in our analysis.

Outputs

The proposed model includes outputs related to intercollegiate athletics success, collegiate athletics revenues, and Title IX compliance.

The Directors' Cup is a competition aimed at recognizing the most successful collegiate athletic programs in the US. The competition is organized by the National Association of Collegiate Directors of Athletics (NACDA). In the Directors' Cup, each educational institution is awarded points in a certain number of sports for both men and women. The proposed DEA model incorporates the number of points recorded by each institution in the 2013 Directors' Cup standings as an estimate of intercollegiate athletics success. In the year 2013, Michigan State University, for example, recorded 670.50 points across 10 men's and 10 women's sports.

In terms of collegiate athletics revenues, the DEA model uses the revenue data included in the OPE Equity in Athletics database. These estimates include revenues from actual ticket and luxury box sales, contributions from alumni, fund-raising activities, sponsorships, state or other government support, and any other revenues related to intercollegiate athletic activities. For instance, total collegiate athletics revenues at Michigan State University in the year 2013 totaled \$86,586,155.00.

With respect to Title IX compliance, the model uses two output measures that are based on enrollment figures, athletic participation, and scholarship aid information data included in the OPE Equity in Athletics database. The first measure, Participation Achievement, estimates the degree to which an institution has met their enrollment proportionality target. For example, at Michigan State University 50.51% of the undergraduate students were women in 2013. In that same year, there were 916 athletic participants at the Michigan State University, of which 49.78% were women and 50.22% were men. The 2013 Participation Achievement estimate for Michigan State University would be 98.55%.

The second measure, Scholarship Achievement, estimates the proportion of dollars spent on scholarships for male and female athletes to the proportion of male and female student athletes. For example, 49.78% of student athletes were women at Michigan State University in the year 2013, while 45.82% of athletic student aid money was allocated to female participants. The 2013 Scholarship Achievement indicator for Michigan State University is estimated to be 92.04%.

The table below displays a summary of the output measures for all institutions included in our study (summarized by conference).

TABLE 1
Mean DEA Model Outputs

Athletic Conference	Directors' Cup Pts.	Total Revenue	Participation Achievement	Scholarship Achievement
ACC	603.86	\$74,646,608.83	91.59%	93.22%
American	260.66	\$57,035,349.88	91.84%	92.26%
Big 12	575.77	\$92,881,695.30	99.20%	86.89%
Big Ten	748.83	\$103,155,757.36	97.24%	94.74%
CUSA	75.00	\$26,705,829.55	84.22%	92.06%
Independent	394.00	\$52,306,622.00	100.60%	87.36%
Mid-American	119.82	\$26,401,731.23	93.63%	88.16%
Mountain West	180.00	\$32,921,371.00	99.63%	86.00%
PAC-12	644.23	\$77,998,683.80	99.29%	90.17%
SEC	718.18	\$98,526,536.36	88.20%	97.53%
Sun Belt	93.71	\$20,733,315.00	70.79%	94.25%
Mean	418.40	\$62,510,050.17	92.36%	91.47%

Inputs

Five input measures are used in the proposed DEA model: the salaries of athletic directors, total coaches' and total assistant coaches' salaries, operating expenses, and recruiting expenses. Athletic directors' salaries were obtained from the USA Today athletic director salary database, while the remaining input estimates were retrieved from the OPE Equity in Athletics database.

A summary of the input measures for all institutions included in our study (summarized by conference) are presented in the table below.

TABLE 2
Mean DEA Model Inputs

Athletic Conference	Operating Expenses	Recruiting Expenses	Athletic Director Salary	Coaches' Salary	Assistant Coaches' Salary
ACC	\$9,376,455.42	\$1,266,514.92	\$600,829.75	\$6,765,098.33	\$6,120,694.58
American	\$8,836,516.50	\$864,869.88	\$552,271.50	\$5,430,913.13	\$4,179,665.63
Big 12	\$10,802,779.90	\$1,370,494.90	\$700,978.60	\$8,514,084.40	\$5,983,300.40
Big Ten	\$12,665,118.18	\$1,671,502.45	\$712,164.09	\$8,501,835.00	\$6,387,767.55
CUSA	\$4,312,147.45	\$465,126.18	\$272,591.55	\$1,897,575.09	\$1,975,270.27
Independent	\$8,813,675.00	\$934,072.67	\$485,312.00	\$3,499,887.33	\$3,990,724.33
Mid-American	\$3,622,522.54	\$444,356.92	\$228,471.62	\$1,976,659.85	\$2,137,618.15
Mountain West	\$4,947,952.64	\$613,263.09	\$307,644.55	\$2,922,637.55	\$3,075,485.00
PAC-12	\$10,521,867.00	\$1,164,198.90	\$508,415.80	\$6,999,686.00	\$5,659,243.70
SEC	\$11,068,737.21	\$1,680,231.71	\$857,971.07	\$8,658,138.71	\$6,908,843.29
Sun Belt	\$3,090,002.43	\$391,230.00	\$181,251.43	\$1,655,145.71	\$1,921,363.14
Mean	\$8,070,542.03	\$1,023,214.52	\$505,862.70	\$5,411,862.86	\$4,536,994.63

RESULTS

Efficiency scores were calculated for each school by solving the model 110 times (i.e., once for each school included in the study). The DEA model results, summarized by athletic conference are displayed in the table below.

TABLE 3
Summary of DEA Model Results

Athletic Conference	DMUs	Efficient DMUs	Mean Efficiency Score
ACC	12	5	90.08%
American	8	0	82.63%
Big 12	10	4	88.80%
Big Ten	11	5	94.64%
CUSA	11	2	88.18%
Independent	3	1	94.00%
Mid-American	13	9	97.92%
Mountain West	11	2	90.18%
PAC-12	10	5	95.40%
SEC	14	5	91.93%
Sun Belt	7	5	98.29%
Total	110	43	91.97%

Our DEA results indicate that, based on their levels of intercollegiate athletic success, revenue generation and compliance achievement, certain institutions are more efficient than others in terms of their use of athletic financial resources.

The model results can also be used to identify the amount and type of excess resources used by inefficient DMUs. Those excess resources represent savings that could be achieved if inefficient DMUs were to perform as efficiently as the ‘best practice’ institutions. The table below displays the mean target input values for all the institutions included in our study summarized by conference.

TABLE 4
Summary of Efficient Input Targets

Athletic Conference	Operating Expenses	Recruiting Expenses	Athletic Director Salary	Coaches' Salary	Assistant Coaches' Salary
ACC	\$8,788,835.41	\$1,126,686.49	\$529,378.64	\$5,868,968.21	\$5,677,518.43
American	\$7,460,691.88	\$770,741.28	\$430,824.93	\$4,156,371.28	\$3,736,421.71
Big 12	\$10,175,161.08	\$1,223,481.42	\$644,279.04	\$7,486,062.06	\$5,641,344.44
Big Ten	\$12,253,196.08	\$1,601,964.60	\$652,378.43	\$7,648,259.11	\$6,185,178.32
CUSA	\$3,831,054.97	\$400,865.94	\$233,451.44	\$1,670,842.67	\$1,839,077.52
Independent	\$7,395,725.64	\$820,792.80	\$414,673.66	\$3,234,331.05	\$3,730,924.40
Mid-American	\$3,583,348.37	\$440,342.50	\$220,387.64	\$1,950,408.95	\$2,084,655.62
Mountain West	\$4,588,116.91	\$532,823.66	\$282,245.49	\$2,612,578.97	\$2,839,491.30
PAC-12	\$10,258,472.35	\$1,124,903.83	\$493,291.08	\$6,498,920.91	\$5,495,821.29
SEC	\$10,377,721.21	\$1,551,144.28	\$613,442.70	\$7,440,990.53	\$6,541,531.50
Sun Belt	\$3,061,818.99	\$335,067.96	\$179,378.41	\$1,505,975.34	\$1,895,608.12
Mean	\$7,567,049.79	\$939,186.76	\$436,150.73	\$4,768,644.64	\$4,291,258.77

Overall, the model results indicate that if inefficient institutions managed their current resources as efficiently as the 'best practice' DMUs, significant input savings could be achieved. Combining the information presented in Table 2 and Table 4, the following potential savings can be estimated.

TABLE 5
Actual vs. Projected Input Levels

Input	Actual	Projected
Operating Expenses	\$8,070,542.03	\$7,567,049.79
Recruiting Expenses	\$1,023,214.52	\$939,186.76
Athletic Director Salary	\$505,862.70	\$436,150.73
Coaches' Salary	\$5,411,862.86	\$4,768,644.64
Assistant Coaches' Salary	\$4,536,994.63	\$4,291,258.77

Alternatively, the model results can also be used to estimate the output levels that could be achieved by an inefficient DMU without the need of additional resources. Mean target output measures for all the institutions included in our study (summarized by conference) are presented in the table below.

TABLE 6
Summary of Efficient Output Targets

Athletic Conference	Directors' Cup Pts.	Total Revenue	Participation Achievement	Scholarship Achievement
ACC	654.88	\$78,662,303.30	99.17%	103.92%
American	318.69	\$62,324,071.01	104.63%	112.50%
Big 12	602.77	\$97,507,120.66	107.10%	104.30%
Big Ten	803.84	\$106,144,972.62	104.55%	106.00%
CUSA	88.32	\$28,464,192.40	92.36%	101.18%
Independent	422.64	\$55,618,505.16	112.00%	110.00%
Mid-American	127.41	\$26,668,818.95	94.69%	95.38%
Mountain West	205.27	\$35,995,803.95	104.73%	106.55%
PAC-12	672.17	\$79,736,227.72	102.00%	100.90%
SEC	744.23	\$102,282,200.25	100.00%	108.43%
Sun Belt	94.86	\$20,937,054.19	72.86%	95.43%
Mean	447.61	\$65,306,260.86	99.21%	103.69%

Combining the information presented in Table 1 and Table 6, the following potential improvements can be estimated.

TABLE 7
Actual vs. Projected Output Levels

Output	Actual	Projected
Directors' Cup Pts.	418.40	447.61
Total Revenue	\$62,510,050.17	\$65,306,260.86
Participation Achievement	92.36%	99.21%
Scholarship Achievement	91.47%	103.69%

In this respect, the model results suggest that if inefficient institutions performed as efficiently as the 'best practice' DMUs, significant output improvements could be achieved.

CONCLUSIONS

The purpose of this study was to develop a model that simultaneously combined multiple financial aspects of athletic department operations with Title IX compliance requirements. In this respect, the study results indicated that certain institutions are more efficient than others and that significant input and output savings could be achieved if all institutions managed their current resources as efficiently as the efficient DMUs,

Our proposed model thus offers a means for evaluating the efficiency or relative performance of decision makers in charge of complying with Title IX federal regulations while, at the same time, competing (and succeeding) in the business of intercollegiate athletics.

It is important to note that a DMU efficiency is only relative to the schools included in a particular data set. If one or more schools were to be added or removed from the data set, a previously efficient institution may be classified as inefficient or, alternatively, an inefficient institution may be classified as efficient. In this respect, institutions should not be compared with other DMUs outside of the corresponding group and time frame.

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**Abstract Submission to SEDSI
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Title:

Controlling transaction costs in buyer supplier relationships: the role of distributive capability and absorptive capacity

Author:

Dr. Kimberly Whitehead, kwhitehead@andersonuniversity.edu

Affiliation:

Anderson University, Anderson, SC

Abstract:

Firm interdependence within modern supply chains continues to grow. This is driven by the need to leverage tangible and intangible resources within the supply chain for innovation, process management, customer satisfaction and meeting diverse stakeholder expectations. This research expands our understanding of supply chain collaboration through the study of knowledge-based constructs that operationalize the abilities of a firm to transfer knowledge. These abilities are referred to as distributive capabilities. The distributive capabilities of an organization represent its ability to transfer commercially relevant knowledge through collaboration to a known recipient firm. Earlier research in this domain has focused on the abilities of a recipient to absorb knowledge, absorptive capacity and has blurred the roles of the source and recipient. This research addresses the relationship between distributive capabilities and absorptive capacity with transaction costs, relationship effort, monitoring, problems and advantage, in buyer-supplier collaborations. It is proposed that distributive capabilities of the source of knowledge in tandem with the absorptive capacities of the recipient of knowledge have direct and significant affects on levels of transaction costs between supply chain partners. Steeped in transaction cost economics and the knowledge based view of the firm, this research expands our understanding of the knowledge transfer process and how that process can be proactively managed in order to reduce complexity and uncertainty in the supply chain and thereby positively affect transaction costs. Propositions are presented that address the affect of knowledge transfer constructs, specifically distributive capabilities and absorptive capacities, to elements of both opportunism and bounded rationality.

ENTREPRENEURIAL SUPPLY CHAIN INFORMATION NETWORKS AND SUPPLY CHAIN ALERTNESS

Xun Li, College of Business Administration, Nicholls State University, PO Box 2015,
Thibodaux, LA 70310, 985-448-4236, xun.li@nicholls.edu

J Robert B. Field, College of Business Administration, Nicholls State University, PO Box 2015,
Thibodaux, LA 70310, 985-448-4181, j.field@nicholls.edu

ABSTRACT

Supply chain alertness is the capability of a firm to identify value-creation opportunities for supply chain management and operations. However, empirical research on the linkage between information networks and supply chain alertness is scarce. We extend social network and entrepreneurship theories to conceptualize an entrepreneurial information network and examine this network pattern in two types of information networks: supply chain benchmarking network and supply chain partner network. Hypotheses are tested on data from 78 firms. The results indicate that firms employing entrepreneurial supply chain benchmarking network and entrepreneurial supply chain partner network enjoy a higher degree of supply chain alertness.

1. INTRODUCTION

It has long been recognized that being entrepreneurial in supply chain management (SCM) plays an important role in a firm's success in global competition. In today's business environment, high-profile CEOs are increasingly focusing on entrepreneurial practices in their supply chains as a basis for competing in new markets [24] [44]. Victor Fung, the CEO of Li & Fung, Hong Kong's largest export trade company and an innovator in supply chain management, recognized that keeping every operating unit entrepreneurial was critical to his company's success in creating customized supply chains for every customer need [41]. The value of entrepreneurship is also revealed in how firms such as Walmart, Toyota, Dell, and Apple have used entrepreneurial practices in supply chain management and operations to gain competitive advantages over their peers [53].

Following the literature of entrepreneurship, whose research focus is on the identification and exploitation of opportunities [22], scholars in the field of supply chain management have shown interest in examining the capability of a firm to discover and exploit opportunities for supply chain management and operations. In recent studies, researchers have conceptualized supply chain alertness as the capability of a firm to identify value-creation opportunities for supply chain management and operations [16] [38] [39] [48], and supply chain responsiveness as the capability of a firm's supply chain to respond and exploit opportunities [5] [38] [39]. In the existing literature, however, the bulk of the empirical studies have focused on supply chain response capabilities with little inquiry into supply chain alertness. Since alertness is the precursor of effective responses [14] [23] [38] [48], empirical insights are needed to understand supply chain alertness and how to nurture it.

In the strategic management literature, social network theories have become central to alertness research. For example, Zaheer and Zaheer [58] suggest that alertness emerges from the manner in which the firm uses its information network. Their testing results on data from the population of 4,088 banks strongly support the notion that alert banks use their information networks in ways that expand the range of information to which they are exposed. Alert and responsive banks tend to exercise greater market influence in industry. In the entrepreneurship literature, it has theoretically proposed that entrepreneurial alertness is associated with the existence and use of an extended social network, but empirical testing has not been conducted yet [2]. Supply chain researchers are now actively importing concepts from the field of social network analysis to the research field of supply chain management [3] [11], but how to use information networks to nurture supply chain alertness has not been examined.

We extend social network and entrepreneurship theories to supply chain management by investigating how supply chain managers use information networks to attain supply chain alertness. The pattern of an information network is conceptualized in terms of two dimensions: tie diversity/range and tie strength. According to Higgins and Kram [21], an entrepreneurial information network has a pattern characterized with strong ties (i.e., frequent and direct interaction) from a wide range of nodes (i.e., across industries). In this paper, we investigate two types of information networks: the supply chain benchmarking network and the supply chain partner network. We contend that a firm with the pattern of entrepreneurial information networks for supply chain benchmarking and supply chain partnering enjoys higher supply chain alertness.

In section 2, we introduce a typology of information networks and illustrate the concept of the entrepreneurial information network. In section 3, we develop research hypotheses concerned with relationships among entrepreneurial supply chain information networks and supply chain alertness. Section 4 describes our data collection, research methods, and results. In section 5, we discuss contributions and propose a research framework for supply chain entrepreneurship. Section 6 discusses research limitations and suggests several future research directions.

2. INFORMATION NETWORK TYPOLOGY

A firm's entrepreneurial processes, activities, and capabilities depend on the information and resources provided by its social networks [1] [58]. Alertness, an important entrepreneurial capability, arises from the manner that firms use their information networks to exchange what they think is happening in their business environment, for example, new market opportunities, best managerial practices, changes in supply and demand, and so on [58]. A firm's positions in information networks are not entirely accidental. Firms can and do strategically influence their information networks [8].

To understand the influence of a firm's information networks on supply chain alertness, we must first discuss the patterns of information networks that a firm can develop. This discussion centers around a typology for information networks we adapt from the work of Higgins and Kram [21]. Although their typology was developed to understand mentoring in a current-career context, we argue that it applies to information networks in other contexts as well. The information network typology is characterized by two network dimensions: network diversity and relationship

strength. We will first explore the two dimensions before describing in detail network patterns yielded from the two dimensions.

2.1. The Dimensions of Information Networks

A firm's information network has two dimensions: network diversity and relationship strength. Information network diversity refers to the range of social systems from which the focal firm (i.e., an ego node in social networks) draws and receives information for work. Relationship strength in an information network refers to the duration and frequency of communication among network participants. The two dimensions are also consistent with core concepts in social network theory and research (for reviews, see [4] and [25]). The capacity for alertness comes not only from privileged and accurate information transferred through strong ties, but also from the availability of information that is sufficient in diversity and detail.

Network Diversity/Range In social network research, the concept of network diversity concerns the extent to which the information provided by different participants in one's network is not similar or redundant [7] [8] [17]. The less redundant the information provided by an ego node's network, the greater its access to valuable resources and information. Here, we adopt range as our specific conceptualization for network diversity: the number of different social systems from which the information ties originate. This is because it more closely captures the real-world environment for a firm's supply chains: each supply chain member owns an independent social system.

Consider the following example to illuminate the premises of network range in a supply chain setting. Suppose there is a focal firm whose information network spans organizational boundaries involving suppliers at different tiers, distributors, third-party logistics providers, and customers. The diversity/range of this firm's information network is relatively high. In contrast, a firm's information network with all ties from tier 1 suppliers has less range. The wider the focal firm's information network range, the less redundant the information provided regarding opportunities for its supply chain management and operations.

Relationship Strength In general, ties may be characterized as strong, weak or indeterminate (as with casual contacts or strangers). For the purpose of characterizing an information network, we consider a relationship continuum that ranges from weak ties (i.e. infrequent communication) to strong ties (i.e., frequent communication). Research from a variety of disciplines has shown that network actors bonded by strong ties tend to be highly motivated to collaborate with each other.

2.2. Patterns of Information Network

As illustrated in Figure 1, the two dimensions of an information network yield four distinct patterns of information networks: (1) entrepreneurial network (characterized by high network diversity/range, high network relationship strength); (2) opportunistic network (high network diversity, low network relationship strength); (3) traditional network (low network diversity, high network relationship strength); and (4) receptive network (low network diversity, low network relationship strength). In Figure 1, information providers are identified with S1, S2, S3, and S4 and the focal firm with F. Consistent with social network research, we depict the

connections between the focal firm and its information provider with lines: solid lines for strong relationships and dotted lines for weak relationships [7]. We use ovals to denote the boundaries of social systems.

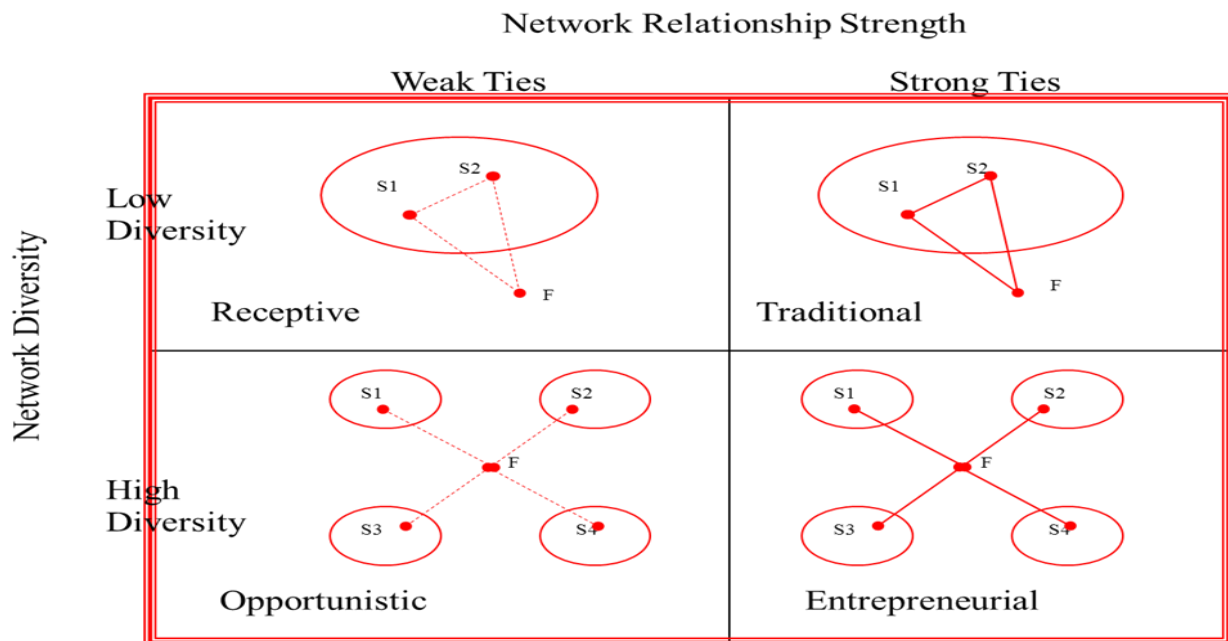


FIGURE1. Information Network Typology (Adapted from Higgins and Kram [21])

Entrepreneurial information networks The entrepreneurial information network captures both the wide ranging nature of the information network (i.e., high network diversity) as well as the high strength of the ties. Burt [8] shows that network configurations characterized with high network diversity can be valuable because they provide access to different sources of information. However, the value of the diverse ties (S1, S2, S3, S4) cannot be realized if the information providers are not motivated to help the focal firm (F) with its work. To yield the benefit of the entrepreneurial opportunities that can be provided by its diverse ties, the focal firm needs to have strong ties simultaneously with its information providers, because strong ties motivate individuals to act on behalf of a local person [18] [32]. Empirical research has shown that strong ties exhibit the highest levels of trust [32] and are particularly helpful during times of uncertainty [33]. Thus, the key distinguishing feature of an entrepreneurial information network is that it is made up of heterogeneous information providers who are highly motivated to act on behalf of the focal firm and who collectively provide the focal firm with access to a wide array of work related information. This network is considered entrepreneurial because it translates into higher potential for product, process, and organizational innovations [27] [49].

Opportunistic information networks The strength of relationships between information providers and the focal firm is what differentiates opportunistic information networks from entrepreneurial networks. The weak ties indicate low levels of reciprocity, infrequency of communication, and emotional distance. In the opportunistic case, the focal firm tends to refrain from reciprocating, communicating, or expressing itself fully. In other words, the information it accesses is opportunistic: the focal firm receives information only when the information is offered or when it asks for help from others, on occasion. The distinguishing feature of an opportunistic network is the focal firm's openness to receive information from multiple sources,

yet assuming a passive stance toward actively initiating and cultivating such information exchange relationships.

Traditional information networks Traditional networks exhibit a clique-like structure comprised of interconnected strong ties [6]. The term traditional is used because these ties come from the same social system (i.e., S1 and S2 are in the same industry). Given that the information providers are affiliated with the same social system, it is likely that there will be interconnection between them. Because traditional networks are less likely to be as large as either opportunistic or entrepreneurial networks, the traditional network is depicted as comprised of fewer network nodes than the other network patterns. In addition, because the information from a network of providers who belong to the same social system is likely to be redundant or highly similar, we expect to find relatively fewer differences in the types of information provided by a traditional information network compared to an opportunistic or entrepreneurial information network. *The distinguishing feature* of a traditional information network is the focal firm is open to receiving information from the same social system and takes a proactive stance toward actively initiating and cultivating such information exchange relationships.

Receptive information network The receptive information network is made up of weak relationships with participants belonging to the same social system. Given the similarity attraction hypothesis [9], these weak ties in receptive networks are expected to be interconnected. As in the traditional information network, the ego actor is more likely to receive similar information; yet unlike the traditional information network, the support provided is less likely to be strong. The distinguishing feature of a receptive information network is the focal firm's openness to receiving information from the same social system, yet assuming a passive stance toward initiating or cultivating such information exchange relationships.

Synopsis: This information network pattern reveals the focal firm's pursuit of information about new opportunities and challenges. A firm with an entrepreneurial network pattern has the best capability in harvesting valuable information relative to firms with other network patterns. In the next section, building on the insights from this information network typology, we examine a firm's information network patterns for supply chain management and operations and how they are related to the firm's supply chain alertness

3. RESEARCH MODEL AND HYPOTHESES

A firm's supply chains are dynamic, specialized units that must maintain flexibility [45]. Each supply chain serves the evolving needs of a set of customers and thus must reconfigure, as needed, to stay aligned with changes in customer needs [20]. To identify those changes (opportunities/challenges) for its supply chain to address, a firm can form and use two types of information networks: the *supply chain benchmarking network* and the *supply chain partner network*.

3.1. Supply Chain Benchmarking Networks and Supply Chain Alertness

A supply chain benchmarking network consists of firms with which a focal firm conducts

benchmarking on supply chain management and operations. A benchmarking network is a learning network. Through benchmarking, a firm can generate new insights that have a potential for reshaping supply chain management processes and operational practices. According to the information network typology introduced in the previous section, a supply chain benchmarking network can assume one of four patterns: entrepreneurial, opportunistic, traditional, or receptive.

A firm can develop benchmarking ties with firms in the same industry. If the relationships are intra-industry and the ties are weak, then the firm has a receptive benchmarking network, and is likely to receive similar information from its receptive networks regarding supply chain processes and performance. In addition, the information provided through weak ties is limited in terms of information quality and quantity. This type of benchmarking network cannot cultivate alertness, which is achieved through the active maintenance of a superior network position that allows acquisition of private information [58].

A firm developing strong benchmarking ties with firms in the same industry (i.e., a traditional benchmarking network) is more alert to opportunities/challenges, compared with firms establishing a receptive benchmarking network. With strong benchmarking ties, the focal firm improves the accuracy of its perceptions about its supply chain management and performance levels in the industry. This enables the firm to have better strategic foresight and systemic insight. *Strategic foresight* is the ability to anticipate discontinuities in business environment, including threats and opportunities in supply chains, the marketplace, and among competitors [48]. The success stories of a variety of firms, such as FedEx and Dell, testify to the role of foresight in shaping competitive supply chain operations. *Systemic insight* is vital for considering the complex interconnection among the firm's capabilities and emerging opportunities [48]. Systemic insight fosters the identification of entrepreneurial opportunities for supply chain operations. However, the low diversity of a traditional benchmarking network constrains the potential of the focal firm to identify opportunities through wide-range scanning. That is, the best supply chain practices may exist in other industries.

Through ties related to benchmarking, across industries, the focal firm can receive information from multiple sources. However, if these ties are weak a focal firm employs an opportunistic benchmarking network. According to Jacobson [26], the opportunistic information network cannot yield superior private information, which is conducive to being alert to opportunities.

By building up strong benchmarking ties across industries, a firm forms an entrepreneurial benchmarking network. The strong ties in the network yield superior private information. Through the diversified ties in the network, the focal firm has wide-range scanning capability – receiving heterogeneous information [21] on supply chain operations from the best of the best. Such information exchange enhances the focal company's capability to make sense of competitive space and triggers knowledge about supply chain management and operations that is not easily imitated [40]. Therefore, an entrepreneurial benchmarking network is believed to be the best network pattern among the others for a firm to proactively seek opportunities, and to attain a high degree of supply chain alertness. Thus, our first hypothesis reads:

***Hypothesis 1:** A firm employing an entrepreneurial supply chain benchmarking network enjoys a higher degree of supply chain alertness than firms with other patterns of supply chain benchmarking network.*

3.2. Supply Chain Partner Networks and Supply Chain Alertness

Supply chain management and operations appear to be, at least in part, a social process. In the modern competitive environment, the ultimate success of a firm depends on its management's ability to understand and integrate the company's intricate network of business relationships in its supply chains [12] [15] [34]. Selecting parties with whom to align and then managing these choice relationships are among the most interesting research domains in business today [35].

Taking a social network perspective, we contend that, to achieve supply chain alertness, a focal firm should manage its supply chain partner network as an information network comprised of supply chain partners that are alert to opportunities and willing to share their information with the focal company. Henceforth, when we refer to a "supply chain partner network," it should be understood that that we are focused on its informational aspects (i.e., its information network). Accordingly, a supply chain partner network conforms to one of the four patterns illustrated in the typology of Figure 1. We further contend that the specific pattern displayed by a firm's supply chain partner network depends on how the focal firm selects its supply chain partners.

When a focal firm selects partners solely on transaction-by-transaction basis, the relationships formed in the focal firm's supply chain partner network are arm's length ties. Arm's length ties are weak ties, because such ties are cool and atomistic, and actors are motivated by incremental profit seeking [54]. Consider, for example, a manufacturer that only uses a supplier for one transaction because that supplier provides the lowest price. The information network derived from such a supply chain partner network is a receptive one. The information transferred is either public knowledge or generic inventory information. Public knowledge is reported through standard instruments such as company reports, audited financial statements, regulatory filings, advertised bid and ask prices, price quotes, contractual stipulations, warranties, and other forms of prepared information accessible in the public domain [55]. Generic, point-of-sale data or inventory status information exchanged in supply chain partner networks are tied to operational processes and provide little insight for strategic redirection. Arm's length ties may promote exploitative learning through the collection and reporting of standard information that enables firms to enhance their current competencies and processes. However, such ties do not afford firms the capability to detect opportunities for innovation through restructuring their competencies and processes [55].

A focal firm can easily establish strong ties with its supply chain partners if that firm also uses the following criteria to select partners: open and honest communication, commitment to a longer term relationship, and responsiveness. Supply chain partners with those traits, showing the ability to understand and rationalize the focal firm's intent, are important toward maintaining a good buyer-supplier relationship [57]. The information network derived from a supply chain partner network composed of strong ties is a traditional one.

Malhotra et al. [40] propose that strong ties between collaborative supply chain partners facilitate privileged, private information sharing between partners, hence enhancing opportunity detection. Privileged information can be related to a firm's strategy, distinctive competencies, undocumented product capabilities, critical customer or supplier dependencies, and so forth [55]. In addition, privileged information is specific to the receiving partners in terms of being proprietary and confidential. It provides the partner a unique perspective not available otherwise. An example of the privileged information exchanges used in the research by Malhotra et al. [40] is an optical electronics manufacturer's effort to inform the channel about the timeframe in which a new product is going to be introduced and the associated transaction plan. The close collaborators (i.e., supply chain partners with strong ties) are given this information six months in advance, while the rest of the supply chain players are only given a month's notice.

Once supply chain participants are engaged in a partner network, how much they can contribute to supply chain alertness is affected by the participants' information network patterns. If a supplier has many strong boundary-spanning ties (i.e., strong connections to other parties from different industries outside the boundary of the supply chain partner network), we say this supplier has good relational capability. Compared to supply chain partners without boundary-spanning ties, supply chain partners with many boundary-spanning ties are more able to be alert and attend to new, divergent ideas sparked by outside connections to different networks [28]. They are freer to take advantage of these ideas without the constraints of inertia (such as established network norms). Strong boundary-spanning ties facilitate the transfer of privileged information from a wide range of sources, thereby enhancing supply chain alertness greatly. Wu and Choi [57] concluded in their case studies that a supplier with good relational capability is more likely to become a solution provider and, consequently, attains a larger share of supply responsibility from the buyer (i.e., the focal firm).

When a firm selects its supply chain partners based on open and honest communication, commitment to a longer term relationship, responsiveness, and relational capability, we say that this firm has an entrepreneurial type of supply chain partner network. An entrepreneurial supply chain partner network is characterized as employing rich media to extend highly complex and/or tacit knowledge, and capable of supporting extensive versus routine problem solving [56]. After all, much of the opportunity identification involved in entrepreneurial pursuits revolves around problem solving [13] [51]. Following the same argument, we have our second hypothesis:

***Hypothesis 2:** A firm employing an entrepreneurial supply chain partner network enjoys a higher degree of supply chain alertness than firms with other patterns of supply chain partner networks.*

4. METHOD

4.1. Sample

The research team attended the Association for Operations Management (APICS) local chapter located in a large city in mid-West of USA to obtain its membership list. This list contains 170 firms. To ensure robust participation rates from appropriate contacts, we contacted top supply

chain executives of these firms, who could help us identify well positioned, informed contacts in their organizations for our research questions. After reading the cover letter, if the contact person did not regard himself/herself as well informed about the research topic, he/she referred us to the right person in that firm. In sum, the research team obtained a sample frame consisting of 78 firms. The informants involved in the interviews were mostly senior supply chain managers and executives, with the balance consisting of division or company presidents. Non-response bias was evaluated using t-Tests on data of employee number and type of industries. No statistical differences were found, thus we conclude that non-response bias is not present. The coverage of a diverse set of industries implies the generalizability of the research findings. The profile of sample firms and respondents is displayed by Table 1.

TABLE1: Profile of Respondents

SIC (2Digit)	Industry Description	Number	Revenue (\$US)	Number
17	Construction - Special Trade Contractors	3	< 20 mn	4
20	Food and Kindred Products	5	20 - 40 mn	6
25	Furniture and Fixtures	5	40 - 100 mn	7
26	Paper and Allied Products	4	100 - 500 mn	11
27	Printing, Publishing and Allied Industries	3	500 mn - 1 bn	13
28	Chemicals and Allied Products	12	1 - 5 bn	6
30	Rubber and Miscellaneous Plastic Products	3	5 - 10 bn	20
32	Stone, Clay, Glass, and Concrete Products	2	10 - 50 bn	4
34	Fabricated Metal Products, Except Machinery & Transport Equipment	2	50 - 100 bn	4
35	Industrial and Commercial Machinery and Computer Equipment	10	> 100 bn	3
37	Transportation Equipment	8	Total	78
36	Electronic equipment & Components	9	Title	Number
50	Construction and Mining Machinery and Equipment	4	Chief SC Officer	2
56	Apparel and Accessory	2	SC Vice President	23
	others	6	President	10
	Total	78	SC Director	7
			SC Manager	36

4.2. Measures

Supply Chain Alertness Drawing upon literature review, we developed 9 items to measure supply chain alertness (e.g., “Detect emerging demand trends in a timely manner”). Respondents answered on a 7-point scale (1=incapable, 7=extremely capable). Appendix displays these 9 items. As reported in Table 2, Cronbach’s alpha and values of composite reliability are all quite high (i.e., well above 0.6), which indicate that the instrument is reliable. All of the nine items have squared loadings greater than 0.5, which provide strong evidence for convergent validity.

Construct validity is achieved as the goodness-of-fit criteria (i.e., Chi-square test, the root mean square error of approximation (RMSEA), the Goodness-of-Fit Index (GFI), and Comparative Fit Index (CFI)) for the measurement model fulfill the recommended threshold values. Based on the validity test results, all the nine items were used in this paper.

TABLE2: Validity and Reliability Evaluation for Supply Chain Alertness

Factor Loadings								
Item1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9
0.549	0.694	0.670	0.574	0.727	0.520	0.714	0.812	0.772
Evaluations of goodness-of-fit and reliability criteria of construct								
			Cronbach's alpha	Composite Reliability	RMSEA	GFI	CFI	
Supply chain alertness ^a			0.84	0.88	0.000	0.939	0.937	
Recommended values ^b			>0.6	>0.6	<0.05	>0.9	>0.9	

^a For Chi-square test, $p=0.061$; ^b[50] [10]

The Pattern of Benchmarking Networks We asked each firm with whom, how, and in what area they benchmark supply chain operations and performance. Based on what each firm provided (the list of their benchmarking subject firms, the benchmarking methods, and benchmarking contents), we coded each firm's benchmarking network. We operationalize tie diversity in terms of industry-spanning range and operationalize the strength of a tie by the frequency of contact with the other party, per Granovetter [17]. Specifically, we regard a firm's benchmarking network as characterized with high diversity if this firm benchmarks with firms within and across industries; we regard a firm's benchmarking network as featured with strong ties if this firm benchmarks with other firms on a frequent basis (e.g., at least annually) through confidentiality arrangements regarding on-site learning of supply chain management and operation practices. We code a firm's benchmarking network as 1, if this firm's benchmarking network displays the pattern of an entrepreneurial network which is characterized with high diversity and strong ties. We code other patterns of benchmarking networks as 0, for example, a firm that benchmarks supply chain practices only with other firms within the same industry and on a random basis. Such a network is of the receptive pattern, having relatively low diversity (within industry) and weak ties.

Two members of the research team coded each firm separately. The inter-rater reliability is computed by taking the ratio of the number of agreements against the total number of observations [43]. Initially, the inter-rater ratio was about 95%. Although the inter-rater agreement greater than 0.65 is considered to be acceptable [47], the research team discussed discrepancies until complete consensus was achieved.

The Pattern of Supply Chain Partner Networks We asked the respondents to describe how they select supply chain partners. We devised a coding schema to determine the two dimensions of a firm's supply chain partner network. If a firm selects supply chain partners on a transaction-by-transaction basis and considers cost saving as the primary selection criterion, we classify the ties between the focal firm and its supply chain partners as weak. We classify ties between the focal firm and its supply chain partners as strong if a firm uses primary selection criteria of open

and honest communication, commitment to a longer-term relationship, and responsiveness (rather than cost savings). If a firm selects a supply chain partner because of its relationship management capabilities within the confines of its industry (e.g., having relationships with other suppliers that have a proven track record only within the industry of the focal firm), we classify diversity of this firm's supply chain partner network as low. If a firm selects a supply chain partner because of its relationship management capabilities both within and across industries (e.g., having relationships with suppliers both within and across industries), we classify the diversity of this firm's supply chain partner network as high.

Using this coding schema, we can assign a value to a firm's supply chain partner network, based on the in-depth data collected. We code a network with high diversity and strong ties as 1, other patterns of network as 0. Initially, the inter-rater ratio was about 90%. Upon completion of discussion on discrepancies by the research team, consensus was achieved.

Controls Firm size, environmental dynamism, environmental heterogeneity, and environmental hostility are control variables for this study. Compared to smaller companies, large companies may have more resources contributing to benchmarking and partner collaboration practices, such as specific personnel for benchmarking, and more influence in supply chain partner engagement due to large-volume purchases. We use number of employees to operationalize firm size and assess its potential influence.

The literature has shown that environmental variables are related with firm's entrepreneurial behaviors [42]. The more dynamic and hostile (i.e., competitive) the environment, the greater the need for firms to be alert to challenges. Another environmental variable that may also be germane is heterogeneity. Firms operating in many different markets are likely to learn from their broad experience with competitors and customers [42], therefore they are more alert to changes. In addition, firms in heterogeneous environments tend to have diversity in organizational personnel, operating procedures, technologies and administrative practices, and are thus more alert to changes. We use the scale items developed by Miller and Friesen [42] to measure environmental dynamism, environmental hostility, and environmental heterogeneity. Appendix displays the items and reliability testing results.

4.3. Data Analysis and Results

Data were analyzed in two stages. In the first stage, a correlation coefficient analysis was performed to evaluate the linear relationship among all variables in this study. Table 3 provides the means, standard deviations, and correlations for the study variables. In the second stage, hierarchical regression analyses were conducted to test hypotheses concerning relationships between antecedents and supply chain alertness. Table 4 displays the hypothesis testing results on the relationships between the pattern of information networks (i.e., benchmarking network and supply chain partner network) and supply chain alertness.

TABLE3: Correlation Table

	<i>Mean</i>	S.d.	1	2	3	4	5	6
Firm size	17050.06	53512.11	1					
Dynamism	10.72	3.44	0.12	1				
Heterogeneity	10.92	4.02	0.28*	0.41**	1			
Hostility	16.97	4.22	-.01	0.3**	0.22	1		
SCBN	0.25	0.44	0.24*	0.05	0.14	-0.07	1	
SCPN	0.25	0.44	0.31**	0.18	0.19	0.02	0.4**	1
SCA	42.22	8.86	0.34**	-0.1	0.16	-0.13	0.38**	0.39**

Note: ** p < 0.01, *p<0.05; SCBN: supply chain benchmarking network; SCPN: supply chain partner network; SCA: supply chain alertness

TABLE4: The Results of Hypotheses Testing

Antecedents	Supply Chain Alertness	
	Step 1	Step 2
<u>Control Variables</u>		
Firm Size	0.316**	0.201*
Environmental Dynamism	-0.169	-0.194
Environmental Heterogeneity	0.168	0.128
Environmental Hostility	-0.113	-0.089
<u>Independent Variables</u>		
Pattern of SCBN		0.205*
Pattern of SCPN		0.225*
Adjusted R ²	0.122	0.239
F	3.719*	5.074*

Note: *p < 0.05, **p < 0.01

SCBN: supply chain benchmarking network; SCPN: supply chain partner network

All hypotheses receive strong support with significant coefficient estimates. Hypothesis H1 is supported (Beta = 0.205; p < 0.05). A firm with an entrepreneurial benchmarking network enjoys higher supply chain alertness than firms with other patterns of benchmarking networks.

Hypothesis H2 is supported (Beta = 0.255; p < 0.05). A firm with entrepreneurial type of supply chain partner network has higher supply chain alertness than firms with other network types. The difference of adjusted R- Square values indicates that 11% variance of supply chain alertness is explained by the network variables, evidencing that the effect of our predictors on supply chain alertness is impressive.

5. DISCUSSION

This research examines the important role of supply chain information networks for firms that seek to build up supply chain alertness (i.e., the capability to identify value-creation

opportunities for supply chain management and operations). The results indicate that a firm with *entrepreneurial* information networks employed in benchmarking and partnering operations enjoys a higher degree of supply chain alertness.

Empirical research on entrepreneurial capabilities has been challenged by difficulties of measurement due to the inherent problems in observing detailed internal characteristics of firms. Here, we describe and illustrate a unique way of characterizing a firm’s information network patterns to gauge the firm’s entrepreneurship orientation. The pattern of an information network is conceptualized in terms of two dimensions: tie diversity/range and tie strength. An entrepreneurial information network has a pattern characterized with strong ties (i.e., frequent and direct interaction) from a wide range of information suppliers (i.e., across industries). In this study, we examine two types of information networks: supply chain benchmarking network and supply chain partner network. As expected, a firm building up the pattern of an entrepreneurial information network in its benchmarking and supply chain partnerships enjoys a higher degree of supply chain alertness. The theoretical implication of this finding is that entrepreneurial capabilities (e.g., supply chain alertness) are driven by the firm’s propensity to build up its information networks entrepreneurially.

This research extends the precepts of entrepreneurship to supply chain settings. Figure 2 displays the general framework used by researchers to address why, when, and how some individuals become entrepreneurs. This general framework is based on the combination of the Austrian School of economics [29] [30] and cognitive psychology [31]. We can illustrate this framework briefly as: because of knowledge asymmetry (Austrian approach), personal differences [e.g., locus of control [19], and beliefs, individuals vary in their ability to recognize opportunities. Opportunity recognition is the precursor of actions to exploit opportunities.

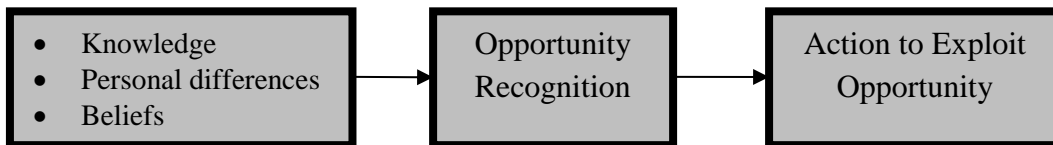


FIGURE2. A General Framework for Entrepreneurship

We extend this framework to the study of supply chain entrepreneurship as indicated in Figure 3. The pattern of a firm’s information network for supply chain management and operations reveals firm differences in terms of knowledge, alignment among network members, and trust. These differences determine how alert a firm’s supply chain can be (i.e., its capability to detect opportunities). Supply chain alertness is an important precursor for firms that attempt to execute supply chain operations driven by opportunity exploitation.



FIGURE3. A General Framework for Supply Chain Entrepreneurship

6. LIMITATIONS AND FUTURE RESEARCH

We recognize some inherent limitations in this study and opportunities they present for future research. First, the task of obtaining an adequate sample size was challenging. Second, the impact of other resource networks on supply chain alertness is not examined. Third, although we diligently sought to control for response bias due to one-sided (manufacturer-centric) views of supply chain alertness, we recognize that the effect of such a bias may still persist. Forth, because this is a cross-sectional study, we cannot comment on the effect of network change on supply chain alertness over time. To do that, a longitudinal study is needed. While this study contains limitations, limitations provide opportunities for future research. A broader respondent base within the supply chain and a larger sample size with longitudinal data may enable researchers to observe and analyze the interactions and interdependencies among supply chain resource networks, supply chain alertness, and heightened competitive performance.

By combining research from three areas (social networks, entrepreneurship, and supply chain management), the proposed framework for supply chain entrepreneurship can be used to guide future research in many directions. From the network literature, in addition to tie diversity/range and tie strength introduced in this research, scholars can investigate how other network variables are related to supply chain alertness. For example, network embeddedness is the mechanism whereby an entrepreneur becomes part of the local structure and learns how to draw on and use the resources provided by available social capital [1]. Supply chain settings provide an opportunity for scholars to extend this idea from the traditional level of individuals to an inter-firm level by investigating the relationship between network embeddedness and supply chain alertness.

In the entrepreneurship literature, organizational rejuvenation is an important corporate entrepreneurship form by which the organization seeks to sustain or improve its competitive standing by altering its internal processes, structures, and/or capabilities [37] [46] [52]. This phenomenon is sometimes referred to as organizational renewal or corporate rejuvenation in the corporate entrepreneurship and competitiveness literature [59]. A firm's supply chain management and operations are about managing complex work systems involving multiple hierarchical levels within a firm and horizontally spanning across firms. Supply chain entrepreneurship opens a new research domain that requires scholars to examine new processes, structures, and capabilities that enable a firm to rejuvenate its supply chains through opportunity identification and exploitation. For future research, scholars can look at how supply chain alertness is related to new product development speed, make-to-order operations, lean and agile manufacturing, mass customization, and other operations methods seeking to exploit opportunities in the marketplace.

This research speaks to supply chain managers. It suggests to them that proactive establishment and use of information networks for supply chain management and operations can help them to access distinct, valued resources and competitive capabilities. Specifically, it underscores the need for firms to think about how to build benchmarking networks and supply chain partner networks as information networks. It also highlights the role of tie diversity/range and tie strength in the information networks in order to access rich information. The value of supply chain alertness is also clear. Supply chain alertness is an intangible, difficult-to-imitate capability

for firms operating in a dynamic environment. Firms with high supply chain alertness can serve the customer better by customizing to their needs through expeditious product/service development and provision, yielding heightened competitiveness.

APPENDIX MEASUREMENT ITEMS

Measurement Items for Supply Chain Alertness

Supply chain Alertness	Use the 1-7 scale below and assign a score to each item for your supply chain, where: 1 = Incapable, 4 = Moderately Capable, 7 = Extremely Capable, U = Don't know	Literature Source
Item 1	Monitor economies to detect new supply bases in a timely manner	[36] [39]
Item 2	Detect emerging demand trends in a timely manner	[12] [36]
Item 3	Detect unexpected changes in the relationship with key supply chain partners in a timely way (for example, a key supplier forms a partnership with your competitor)	[48] [36]
Item 4	Identify new technologies for supply chain management in a timely manner	[48]
Item 5	Detect misalignment between our company's supply chain design and business objectives in a timely manner.	[48]
Item 6	Identify macro-economic changes (for example, exchange rate fluctuation, national regulation change) in a timely manner that affect our supply	[36] [39]
Item 7	Detect unexpected changes in the information flow in our supply chains in a timely manner (for example, a key supplier or customer stops sharing information relevant to supply chain operations)	[34][48]
Item 8	Monitor to detect unexpected disturbances/threats in carrying out supply chain operations (for example, accidents or a weather issue) in a timely manner that would affect our supply	[5]
Item 9	Detect unexpected changes in the goods/service movement throughout our supply chains in a timely manner	[34]

Measurement Items for Business Environment (adopted from Miller and Friesen [50])

Please Answer the following questions for the industry that accounts for the largest % of your sales (in other words, your principal industry).	
Environmental Dynamism (Cronbach's Alpha=0.618)	
Item 1	1 = Our firm rarely changes its marketing practices; 7 = Our firm must change its marketing practices extremely frequently
Item 2	1 = Demand and consumer tastes are fairly easy to forecast; 7 = Demand and consumer tastes are almost completely unpredictable
Item 3	1 = The production/service is not subject to very much change and is well established; 7 = The modes of production/service change often and in a major way

Environmental Heterogeneity (Cronbach's Alpha=0.606)	
Item 1	1= We are a very undiversified firm and cater to the same customers; 7 = We are a highly diversified conglomerate and operate in many unrelated industries
Item 2	1 = Our customers' buying habits are about the same for all our products/services; 7 = Our customers' buying habits vary a great deal from one line to another
Item 3	1 = The nature of the competition is about the same for all our products; 7 =The nature of the competition varies a great deal from one line to another
Environmental Hostility (Cronbach's Alpha=0.60)	
Item 1	1 = Tough price competition is not a great threat to us; 7 = Tough price competition is a very substantial threat
Item 2	1 = Dwindling markets for products is not a great threat to us; 7 = Dwindling markets for products is a very substantial threat to us
Item 3	1 = Competition in product quality or novelty is not a big threat to us; 7 = Competition in product quality or novelty is a very substantial threat

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**Effect of Delivery Lead Time on Production Policy in a Two-Tiered Supply Chain
with Constrained Supply**

Dmitriy Shaltayev
Luter School of Business,
Christopher Newport University,
1 Avenue of the Arts,
Newport News, VA 23606
dmitriy.shaltayev@cnu.edu

Borga Deniz
Department of Business,
Framingham State University,
100 State Street,
Framingham, MA 01701
bdeniz@framingham.edu

Joona Rahko
University of Oulu,
Pentti Kaiteran katu 1,
90014 Oulu, Finland
joona.rahko@oulu.fi

Robert Hasbrouck
Luter School of Business,
Christopher Newport University,
1 Avenue of the Arts,
Newport News, VA 23606
rhasbro@cnu.edu

ABSTRACT

In this research we investigate suppliers' production policy in a two-tiered supply chain. Most supply chains and industries operations have production capacities that exceed the market needs. According to the Federal Reserve (<http://www.federalreserve.gov/releases/g17/Current/>), the average capacity utilization in the industrial sector is 77.5% in September 2015. This means that a typical supplier chooses not to utilize fully his excessive capacity. If he did, this would result in overproduction, buildup of inventories and excessive holding costs. In this research we investigate the question what production policy should be adopted by a supplier to minimize his inventory related costs (holding and backordering), and what effect does this policy have on retailer's product availability.

INTRODUCTION AND LITERATURE

One of the biggest factors on a supply chain's success is its managers' ability to handle uncertainty. In real life uncertainty is present on the demand process as well as the supply process. Due to increasingly global nature of most supply chains they are subject to uncertainty at many levels. In this article we analyze the extent of the effect of demand uncertainty on supply chain performance measures. Using discrete time simulation we study a two-tier supply chain with multiple retailers and multiple suppliers in order to gain managerial insight.

In the literature, there are a number of articles that uses simulation to study supply chains with multiple suppliers and/or retailers. Choudry et al. (2008) studied a two-tier capacitated supply chain with single supplier (manufacturer) and multiple identical retailers. They analyzed the effect of a number of factors such as end item demand variability, production availability, the number of retailers, and information sharing between channel members on the performance of a supply chain using discrete event simulation. They optimized the decision variables in their model such as the order-up-to and safety stock levels for retailers and start-up and shut-down levels for the manufacturer using response surface methodology and comparing three different information sharing strategies via simulation. Huang and Gangopadhyay (2004) conducted a simulation study in a tree-like, four-tier supply chain setting (a manufacturer, two wholesalers, four distributors, and eight retailers) to measure the impact of information sharing among supply chain partners. Their results suggest that distributors and wholesalers benefit from information sharing significantly in terms of backorders and inventory levels, however, retailers do not. Abuhilal et al. (2006) used simulation to study a three-tier supply chain (a supplier, a manufacturer and a retailer) to compare JIT, MRP and MRP-with-information-sharing strategies

for a manufacturer under stationary and cyclical demand. Their results show that JIT reduces inventory levels and that information sharing between supply chain stages causes significant cost reduction for an MRP system, particularly when demand is cyclical and highly variable. Angulo et al. (2004) studied a four-tier supply chain setting (a manufacturing plant, a vendor distribution center, a retailer distribution center, a retailer store) via discrete-time simulation. They conclude that sharing forecasts should be implemented first on products with increasing or decreasing mean demand rates. Chin et al. (2012) conducted a simulation study in a three-tier supply chain setting; a manufacturing plant, five warehouses, four clients for each warehouse. There are six different products that are made in the plant and sold through the warehouses. The study uses simulation to verify that a pull-type Theory of Constraints Supply Chain Replenishment System (TOC-SCRS) performs better than a push-type replenishment system by minimizing the bullwhip effect. A review of multiple-supplier inventory models is provided by Minner (2003). Ganeshan (1999) studies a supply chain model for a production/distribution network with multiple suppliers, a central warehouse and multiple retailers. He provides an (s, Q) -type inventory policy at both retailer and warehouse level as a heuristic solution under stochastic demand and lead time subject to customer service constraints. Jaber and Goyal (2008) developed a deterministic mathematical model to improve coordination in a three-level, centralized supply chain with multiple retailers, a manufacturer, and multiple suppliers.

THE MODEL

In this research, we investigate a two-tier, non-perishable goods supply chain, which consists of r retailers and s suppliers operating within a market. We assume that each retailer has a primary supplier, from which he tries to procure inventory at the beginning of each time period. We assume that each supplier has same number of retailers, for which this supplier serves as primary. Therefore, we can view the market as consisting of submarkets where retailers are assigned equally to each supplier. In these submarkets, the retailers will always first look for goods from their primary supplier. We will assume that suppliers have limited supply availability, associated with the production capacity. Sometimes such limited supply availability can be attributed to natural causes, as, for example, in fishing industry. While a fishing company can forecast an average expected fishing yield, it cannot guarantee it, because weight of fish caught is inherently stochastic. If the supplier cannot fulfil all of the submarket's retailers demand, then the supplier distributes its available inventory among "assigned" retailers proportionally according to each retailer's order size. In this case supplier has no inventory remaining, and retailers, "assigned" to him are still in the market looking to fulfill their desired order quantities. If the primary

supplier cannot fulfill all of retailer orders, then the retailers with remaining demand will order the missing goods from one of the remaining suppliers with highest available inventory. At the beginning of the next period, the submarket setup remains the same as retailers are assumed to be assigned to the same primary supplier.

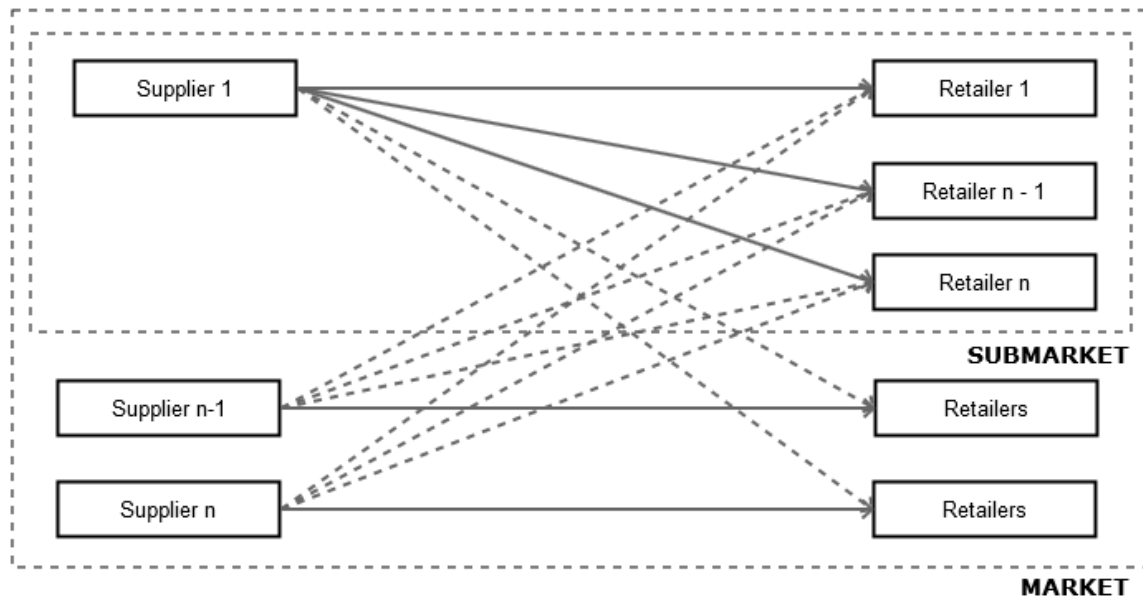


Figure 1. Two-Tier Supply Chain with Multiple Retailers and Multiple Suppliers. Includes a Depiction of the Submarket-Market Setup.

In order to simplify the model, we assume that each retailer offers the same product to customers with no price differentiation. Demand experienced by the retailers each round is normal and identically distributed. In our model, we also assume that delivery of an order from a supplier to a retailer in general has a lead time L . Due to the non-perishable nature of the goods, the inventory always carries over to next period, unless it is consumed by the customer demand. In our model, any unmet consumer demand or retailer demand carries over to the next period. Unmet consumer and retailer demand results in a shortage cost. On the contrary, any excess inventory held by the supplier or the retailer has a holding cost. We use three different delivery methods in our model. Each of these delivery options are equally fast, but they have a different cost. The selected shipping method based on the retailer’s order size. Larger orders are cheaper per product, whereas smaller orders are more expensive per product. This introduces economies of scale in the model.

In our model, the market operates in three distinct phases. In phase 1, each supplier produces a random yield of n amount of goods. Supplier’s target supply varies according to the supplier’s ending inventory. The yield is normally distributed. During phase 1, the retailers place orders to suppliers. The

order size is determined by the retailer's pipeline inventory, ending inventory and service level. If any retailer still requires more inventory after the initial ordering phase, they may order more goods from secondary suppliers – this is if they have any goods left. This is what we call phase 2 in our model. In phase 2, a random retailer with unmet demand is selected and its demand is fulfilled using the goods from the supplier that has the highest available supply. Phase 2 ends, when retailer demand has been met or suppliers have ran out of inventory. In phase 3, customers purchase inventory from the retailer. After phase 3, ending inventories for both the suppliers and retailers are calculated. If the ending inventory for either the retailer or supplier is negative, a backorder cost is incurred. On the contrary, if the ending inventory is positive, a holding cost is experienced.

METHODOLOGY

If the deliveries from suppliers to the retailers are instant (i.e. with zero lead time), then total cost of procurement of required quantities increases. This is associated with two factors. First, each time the retailer orders goods from a supplier, a usual fixed ordering cost is incurred. Second, if a retailer is forced to seek additional units from a secondary supplier, such supplier needs to be located on the open market first. Search of suppliers with available inventory of the open market takes time and resources and therefore has a cost associated with it. The focus of this paper is supply chain with non-perishable item and non-instantaneous delivery. In this model ordering cost is less affected by supply chain parameters: out of all cases considered variation of total ordering cost (primary plus secondary) was between 129.19 and 141.38, or 8.62% ordering cost reduction in the best case scenario.

On the other hand, retailer's average inventory related cost (holding and backordering) varied between 26,417.73 and 104.38. Supplier's average inventory related cost (holding and backordering) varied between 415.07 and 9.56. These results indicate that under various supply chain parameters retailer's average ordering cost remains relatively stable. Simple explanation of this behavior can be explained by positive lead time and positive product shelf life. Indeed, positive lead time means that the retailer knows each time period how much product is coming in. If quantity is insufficient, retailer's order is increased. At the same time any unsold product becomes a part of the on-hand inventory at the beginning of next time period, providing a retailer with a safety net in case incoming order will not be sufficient to cover uncertain demand. Under these circumstances retailer becomes less dependent on secondary supplier, and the role of secondary orders becomes diminished.

Base case which we considered was stochastic demand with a stochastic supply, when total average demand matches total average supply. We found that under these circumstances the biggest part of supply chain total cost is retailer's average backordering cost. Indeed, as an average retailer follows inventory his policy targeting certain cycle service level, he targets certain level of safety stock, protecting himself against inventory buildup. But because supplier's yield is stochastic and limited each time period, retailer is not protected against shortages.

To model more realistic scenarios, we considered cases where total supply (yield) in the industry exceeds total demand faced by retailers. If total suppliers' yield is higher than total customers' demand, each retailer is more likely to receive units needed, reducing retailers' average backordering cost. But in this case the biggest part of the supply chain cost becomes supplier's average holding cost. It makes sense since the supplier has extra capacity and produces on average more yield than will be demanded by customers. Retailers will optimize their inventory and backordering levels by following inventory policy which balances their overage and underage costs, and any supply not purchased by the retailers is left at the suppliers, driving their inventory holding costs up.

In order to optimize supplier's cost we have included two opportunities for supplier's yield reduction. First, if a supplier has leftover stock from previous time periods, he may use this stock to meet retailers' demand, and produce less. We have considered the following levels of average yield reduction (in percentages of supplier's ending inventory):

- 0%, 50%, 100%, 150%, 200%, 250%, 300%, 350%, 400%, 500%, 1,000%

For example, if the supplier's yield is 300 units per time period, and he has 10 units of ending inventory, his next period average yield will be reduced from 300 units by 0, 5, 10, 15, 20, 25, 30, 35, 40, 50, or 100 units, correspondingly.

Second, if a supplier ends up with ending inventory enough to fulfill average demand from retailers, assigned to him, supplier stops production for one time period to let the inventory go (stop-production rule).

Both yield reduction and stop-production rules can be found in practice in many supply chains. Auto manufacturers normally have more capacity than the demand for cars, and if the sales start to decline, they may practice a combination of output reduction, or temporary

production shutdown. Both rules are put in place in order to prevent supplier's average holding cost from growing substantially.

In this model we decouple supplier's optimal production behavior from retailer's optimal ordering behavior and consider them separately. First, we fix the retailer's inventory policy and optimize supplier's production policy. Then for the optimal supplier's production policy we find retailer's optimal ordering policy.

SIMULATION DESIGN

A simulation study was performed to investigate the effect of supply chain parameters on two performance measures: average supplier's inventory-related cost and average retailer's cycle service level (CSL). Cycle service level is defined as a fraction of inventory replenishment cycles when the customer demand is satisfied out of retailer's on-hand inventory. In this research we assume that retailer and supplier do not share information, and each supplier makes production decisions aiming to minimize his cost regardless of retailers' targeted levels of product availability.

We discovered that if industry is "balanced" on average, and average supplier's yield is equal to the average demand observed by suppliers "assigned" to him, the average retailer's cost, average supplier's cost and average supply chain cost are high due to increasing retailers' shortage. Such shortage results in increasing retailers' orders, leading to high suppliers' shortages. Therefore, we decided to run simulation with suppliers' average yield higher than average demand observed by retailers, assigned to this supplier. In real settings it is equivalent to suppliers having more production capacity than the market demand. Such extra production capacity resolved retailers' (and suppliers') shortages, but resulted in accumulation of very high inventories at suppliers. But such excess of production capacity should be supplemented with production adjustment policy to avoid accumulation of shortages or leftover inventory. In other words, suppliers should adjust production quantity from one time period to another based on inventory (or shortage) remaining from previous time period. This will allow suppliers to get rid of extra inventory, should inventory buildup happen, or produce extra units (within capacity limitations) to meet higher anticipated orders from retailers, should shortage happen in the previous time period. In this paper we determine supplier production capacity using the following formula:

$$\text{Supplier Production Capacity} = (\text{Cumulative Demand from Retailers Assigned to Supplier}) * SF \quad (1)$$

where supply factor $SF = \{1.0, 1.05, 1.10\}$. Supply Factor (SF) of 1.0 indicates that each supplier's production capacity matches exactly the average demand of retailers "assigned" to a supplier. Supply Factors of 1.05 and 1.1 indicate that each supplier has extra 5% and 10% production capacity, correspondingly, compared to average demand. So, if average demand experienced by a retailer is 100 units per period, and each supplier has three retailers "assigned" to him, then the three levels of SF correspond to the production capacity of 300, 315, and 330 units, correspondingly.

We considered three production models:

- 1) Yield reduction only (YRO)
- 2) Stop-production only (SPO)
- 3) Stop-production and yield reduction (SPYR)
- 4) Dynamic yield adjustment (DYA)

Yield Reduction Only Policy (YRO)

Under YRO policy it is assumed that the retailer operates at the maximum capacity possible defined by the formula (1) above. But each time period supplier observes ending inventory, and adjusts the production for the next time period as follows:

$$(\text{Average Supplier Yield})_t = (\text{Supplier Production Capacity}) - (\text{Yield Reduction Factor}) * (EI)^+_{t-1} \quad (2)$$

where $(EI)^+_{t-1}$ is a positive ending inventory in previous time period, and Yield Reduction Factor (YRF) can take the values of $\{0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5\}$. So, if the supplier production capacity is 330 units per period, $YRF = 0.5$, and ending inventory of $EI = 20$ units was observed in the previous period, then average supplier yield for current time period is set to 320 units. Note that exact supplier yield for period t is still not known with certainty, as it is a random value from a normal distribution with average yield of 320 units. Formula (2) above sets the average of the yield distribution which supplier chooses after observing leftover inventory. Also note that if supplier observed a shortage in time period $(t-1)$, then $YRF = 0$, and average supplier yield in current time period is equal to the full supplier production capacity given by the formula (1). Under YRO policy the average supplier's yield can theoretically be adjusted each time period.

Stop-Production Only Policy (SPO)

Under SPO policy we assumed that supplier does production adjustments only when ending inventory reaches high value. Specifically, we assumed that if supplier's ending inventory is equal to at least the average demand observed by retailers "assigned" to a supplier, then production is discontinued for one time period. The intuition behind this policy is based on the fact that ending inventory equal to average period's demand is sufficient to cover one period retailers' needs, and additional production will likely result in excessive supplier's holding cost. Note that this policy implies two production levels: full supplier's production capacity given by formula (1) above if ending inventory is insufficient to meet average one-period customers' demand, or zero otherwise. The attractive feature of this policy is its simplicity (all-or-nothing).

Stop-production and yield reduction (SPYR)

This policy is combined from YRO and SPO policies described above. It implies that each time period a supplier is using formula (2) to adjust the average yield each period, if $(EI)_{t-1}^+$ is less than average one period demand observed by "assigned" to him retailers, and stops the production completely otherwise.

Dynamic Yield Adjustment (DYA)

The three policies described above imply that the supplier operates at a certain maximum average production capacity, given by formula (1), adjusting average production rate downwards if necessary. This maximum production capacity represents, in a sense, a limit of production capability of a supplier. These policies assume that depending on the ending inventory from previous time period the supplier adjusts the average yield for the current time period down from this maximum level. Our fourth policy that we consider has no such upper capacity limit. We assume that the supplier starts simulation with the capacity equal to the average demand from retailers "assigned" to him. Each time period supplier adjusts average yield level up or down depending on previous time period ending inventory:

$$(\text{Average Supplier Yield})_t = (\text{Supplier Production Capacity}) - (\text{Yield Reduction Factor}) * (EI)_{t-1} \quad (3)$$

In formula (3) YRF can take same values as in formula (2) above. If the supplier has positive inventory ($(EI)_{t-1} > 0$), then the average supply yield is adjusted downwards. If the supplier has shortage ($(EI)_{t-1} < 0$), then the average supply yield is adjusted upwards. Therefore, DYA policy does not have a fixed maximum production yield. Effectively, it assumes that the supplier has essentially unlimited capability to adjust average yield level, but he chooses to do so in response to the ending inventory.

Policies Comparison

Our goal is to compare the four policies described above to each other. We ran simulation over 10,000 time periods using the four policies. YRO, SPYR, and DYA policies were simulated with the values of $YRF=\{0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5\}$ each. Since the selection of YRF is a supplier's decision, for these policies we compute the average inventory-related cost per one supplier per one period. Under oversupply ($SF=1.05$ and $SF=1.10$), the supplier cost is a convex function of YRF. For each policy we find the value of YRF providing the lowest supplier inventory-related cost, and for this YRF we report a percentage reduction of supplier inventory-related costs compared to the base case of $YRF=0$ (no yield reduction based on ending inventory). At the same time, while supplier chooses production level to minimize his inventory-related costs, his production decisions have an impact on retailers' average cycle service level (*CSL*). Therefore, at the same time we report average retailers' observed cycle service level (*CSL_o*).

EFFECT OF LEAD TIME

Our findings indicate that changes in delivery lead time (while holding other supply chain parameters constant) do not affect the parameters of the supplier's optimal YRO policy in a substantial way.

In the course of simulation we have computed optimal parameters of YRO policy for both supplier and the entire supply chain. Optimal YRO policy parameters are the ones that minimize supplier inventory-related cost and supply chain total inventory related and ordering cost, correspondingly. We found that both optimal supplier inventory-related cost and supply chain total inventory related and ordering cost are not strongly affected by lead time. To illustrate this, Figure 2 below demonstrates

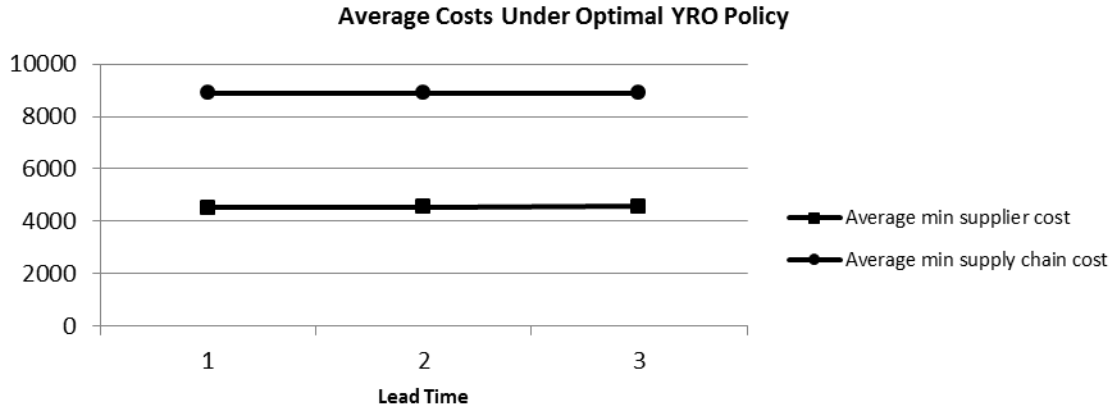


Figure 2. Average Optimal Cost and Average Optimal Supply Chain for SF = 1.0, Number of Suppliers = 2, Retailer-to-Supplier Ratio = 2.0, Low Demand Variability, Low Supply Variability, Target CSL = 0.8.

Note that the above chart is done for the value of SF = 1.0, when total average supply is equal to total average demand. When supply and demand are balanced on average, the majority of the cost (both retailer's and supply chain's) comes from backorders. When oversupply factor is increased from 1.0 to 1.05 and 1.10, the total supply is sufficient to satisfy the demand. In this case there is a dramatic decrease of both supplier's and supply chain's total cost, as is illustrated in Figure 3 below.

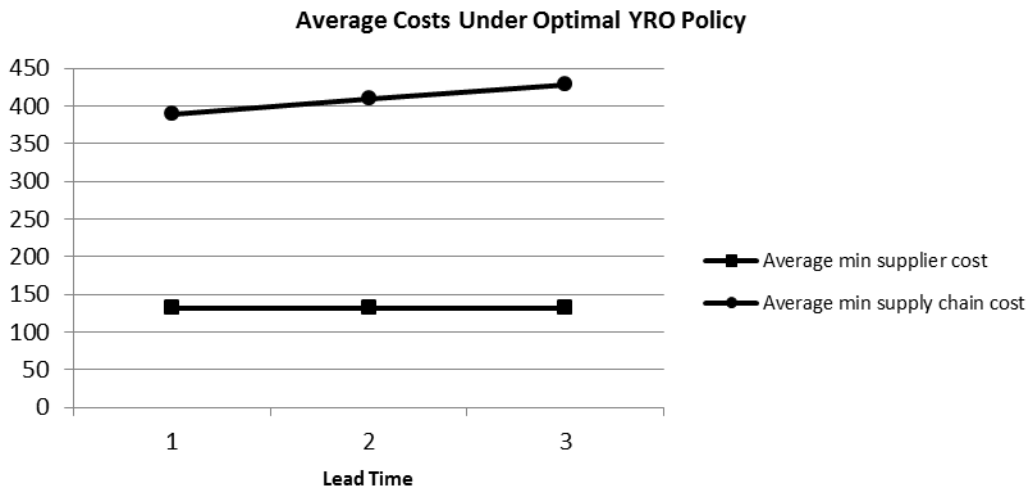


Figure 3. Average Optimal Cost and Average Optimal Supply Chain for SF = 1.05, Number of Suppliers = 2, Retailer-to-Supplier Ratio = 2.0, Low Demand Variability, Low Supply Variability, Target CSL = 0.8.

As one case see from Figure 3, when supply exceeds the demand, the optimal supplier's cost is not strongly affected by the lead time, while the values of total costs are drastically reduced compared to the base case of oversupply factor = 1.0 in Figure 1. Average total supply chain cost, however, tends to increase as delivery lead time increases.

Figure 4 below illustrates that the retailer's average observed cycle service level ($CSLo$) is practically unaffected by the delivery lead time.

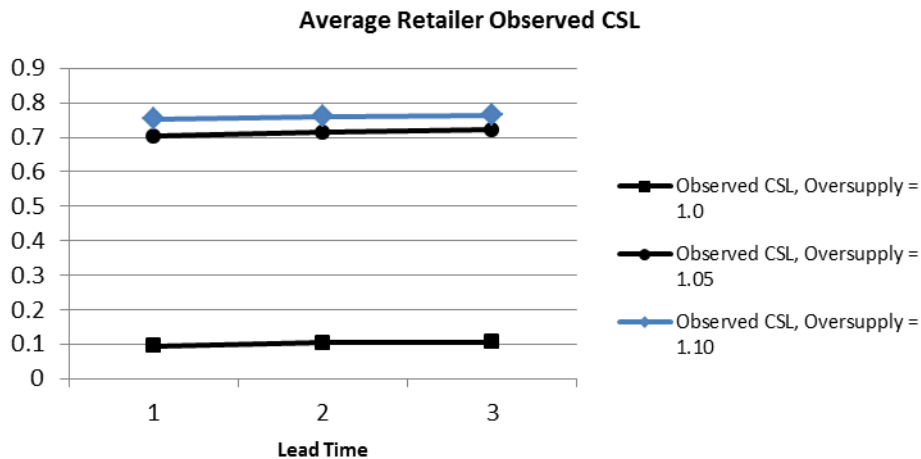


Figure 4. Average Retailer Observed CSL for Number of Suppliers = 2, Retailer-to-Supplier Ratio = 2.0, Low Demand Variability, Low Supply Variability, Target CSL = 0.8.

As one can see, increase in supply (indicated by increasing levels of oversupply factor) results in increase of observed retailer CSL, which makes intuitive sense. Note also that for both SF = 1.05 and 1.10 the retailer on average does not achieve the desired target CSL of 0.8.

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Using an Enterprise Risk Management Framework to Prepare for Natural Disasters

Thomas Buchanan

Email: thomasbuchanan@go.rmc.edu

Phone: 240-357-4527

Randolph-Macon College

Ashland, VA 23005

The Great East Japan earthquake of March 11, 2011 and resulting tsunami striking the Tohoku region damaged or destroyed over one million structures in twenty prefectures claiming nearly 20,000 lives with damages estimated at \$37 billion (USD). As a major seaport, the city of Ishinomaki suffered the greatest centralized damage and four years later struggles to rebuild. Japan experiences earthquakes nearly every day, but rarely of the magnitude felt on 3/11. This project, applies an enterprise risk management framework to aide in the risk assessment, risk management, and mitigation techniques that can be applied to reduce or avoid the cost of damage when primary natural disasters occur. Specific mitigation and intervention methods in the United States and Japan are compared against the severity of the natural event. Particular attention is paid to those methods which have been successful in the Tohoku region.

MUTUAL FUND PERFORMANCE PREDICTION MODEL

Undergraduate Researcher: Stephanie Whitecross
Faculty Sponsor: Ali Nazemi, Ph.D.
Roanoke College 221 College Lane Salem, Virginia 24153 (919) 906-1854
snwhitecross@mail.roanoke.edu

ABSTRACT The purpose of this research is to create a predictive model for mutual fund ratings and returns. This model can aid financial advisors and investors when making decisions regarding mutual fund investments. We obtained a systematic sample of 500 mutual funds from a larger sample of 11,000 mutual funds. Sixty funds were left out of the data analysis in order to test the predictive accuracy of the model. The larger sample was acquired from Wells Fargo advisers. All sampled funds were no load mutual funds. The sampled mutual funds had a mix of large and small market capitalization. For this study, we used the following variables as independent variables: Fund category (Morningstar), return (factor calculated based on one-year return percent, three year return percent, five year return percent, ten year return percent, since inception return percent), Fund age, expenses, alpha, beta, standard deviation, Sharpe ratio, and net assets of funds. The risk and the Morningstar Rating are used as dependent variables to determine the contribution of the each of the aforementioned variable to fund rating and the associated risk. A regression analysis showed a moderate relationship between independent and dependent variables. Future research will include a more comprehensive factor analysis to reduce the number of independent variables and a cluster analysis of a larger sample of mutual funds.

Social Media Marketing Analysis for the Nonprofit Festival Sector: Maximizing Revenue and Attendance Growth

Lauren Mahon, Presbyterian College
lemahon@presby.edu

Social media is one of the fastest growing marketing tactics today, although few master its correct implementation with the ever-changing technological environment and alignment with an organization's overall promotional campaign. In the nonprofit arena, social media marketing is the most cost-conscious and effective tool for the expansion of one's brand. This study focuses on *euphoria*, a food, wine and music festival held annually in Greenville, South Carolina. The analysis of *euphoria* highlights an example of a successful application of digital strategy and presents recommendations for future growth in conjunction with the festival's revenue and attendance objectives.

As part of the analysis, the focus included:

- Identifying the spectrum of media platforms and applications currently utilized by *euphoria* staff;
- Examining the general marketing campaign and historical data provided from the company's most recent years;
- Proposing specific social media plan enhancements for the festival's overall trajectory and objective fulfillment.

What should be in an Analytics Program or Class?

Session Chair: Bob Andrews, Virginia Commonwealth University,
randrews@vcu.edu

Presenters and Panelists:

James Bradley, William and Mary, james.bradley@mason.wm.edu

Kellie Keeling, University of Denver, kkeeling@du.edu

Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Mia Stephens, JMP, mia.stephens@jmp.com

Weiyong Zhang, Old Dominion University, wyzhang@odu.edu

Abstract: In this session the panelists share their respective experiences with developing analytics programs and analytics classes. Several aspects of course and program development will be addressed including content, faculty, textbooks, software and politics. Audience members are encouraged to join in the discussion of these topics.

Session Description:

This session will primarily be an open forum to discuss the proper content for an analytics course or an analytics curriculum. The panel members come from a variety of backgrounds and have a variety of experiences in addition to currently working in a variety of environments. The session will begin with each panelist giving a brief summary of their experience with an analytics class or analytics program. After these initial background presentations, the floor will be opened up for everyone to participate in a moderated discussion so that the session will address topics of interest to those attending. Some of the primary topics that may be addressed include topical content; prerequisite knowledge required; instructional materials such as textbooks, websites, cases and available data sets; computational software, faculty, politics and the level of the program or course. In the allotted time it will only be possible to address a few of these topics in depth. Hence, the desire is to increase the relevance of the session for attendees by allowing them to guide the selection and depth of the topics that will be examined.

Does Calculator Use and Test Format Mask Weakness in Basic Math Ability? Experimental Evidence in Principles of Economics

Melanie Allwine Fennell and Irene Foster¹

Results from an experiment in Fall 2013 of 971 incoming students at George Washington University are reported. In this experiment after students were given an assessment to ensure they had the necessary Algebra I skills to take a Principles of Economics course, they were randomly allocated to a treatment or control group to test if there was a significant impact of test format, calculator use and type, and the interaction of calculator use/ type and test format on students scores. The results from this experiment do suggest that each treatment had a significant impact on students' scores, with much variation depending on the type of question asked.

In results found in Fennell and Foster (2014) it was shown that the Algebra I Assessment was a good predictor of how well a student did in Principles of Economics. It was predicted that students that passed on their first attempt scored 12 percentage points higher than students that failed (significant at the 10% level). However, the SAT Math was found to have little explanatory power with respect to students performance in Principles of Economics, despite the fact that the SAT Math and Algebra I Assessment covered the same material. Fennell and Foster (2014) hypothesized that the reason for this difference in explanatory power was due to the difference in test format and/or calculator use on the assessment and SAT Math.

In this paper we test this hypothesis by running a randomized experiment in George Washington University's Principles of Microeconomics course, randomly assigning students to use and of one of 3 types of calculator (basic, graphing , own calculator) and then randomly assigning students a test format (multiple choice or open-ended) in order to analyze not only the impact of calculator use/type and test format on students mathematical skills necessary to do well in a Principles of Economics course displayed through an algebra i assessment but also the impact of the interaction of test format and calculator type/use.

In Principles of Economics, Algebra I is considered to be a prerequisite at George Washington University. The Algebra I Assessment is given to all incoming Principles of

¹ Corresponding author Irene Foster: George Washington University, 2115 G St. NW Suite 340, Washington, DC, 20052, fosterir@gwu.edu. Melanie Allwine: Fennell Randolph-Macon College, 204 Henry St Ashland, VA 23005 melaniefennell@rmc.edu

Economics students to test their Algebra I skills, as it has been found by professors that students without these skills perform poorly in the class. This was then proven to be the case in Fennell and Foster (2014). The assessment is made up of 20 questions that had a direct relationship to mathematical understanding in economics. The questions cover the same material as the SAT Math. Results upon first giving the assessment were astounding, with a failure rate of over 50%.

The layout of the experiment was to give students an additional assessment (referred to as a questionnaire) after the Algebra I Assessment to test if indeed our hypothesis that test format, calculator use and type, and/or the interaction of the two were impacting students mathematical abilities as demonstrated through their score on the assessment. The experimental design was to randomly assign students (using their respective teaching assistant, as each assessment was administered by teaching assistants during their respective discussion section) to the use/ type of calculator, conditional on students SAT math scores as a proxy of students innate math ability coming into the course. Randomization is done in this way to ensure that there was compliance of students with the restrictions of calculator use/ type and to reduce any unneeded stress on students. To further test any interactions between calculator use and test format, individual students are randomly assigned to a specific test framework (again conditional on students' SAT math scores).

The empirical strategy is to use a difference in difference framework to discern the impact that the test framework and calculator use have on total score of students on the questionnaire, as well as the impact on whether students answered individual questions correctly from treatment. We then also use a difference in difference strategy to test for any interactive impacts of calculator use and test format.

Results suggest that calculator use/ type and test format have an impact on students overall scores on the questionnaire, with an interactive impact from adding a graphing calculator to the multiple choice framework. These results on the overall score are driven by the impact of calculator use/type and test format on students' abilities to answer individual types of questions. We find that for questions relating to Algebra and Functions where a word problem is used and students are expected to write out the functional form and solve for the two unknowns, calculator use and multiple choice alone have similar impacts, while adding a graphing calculator to the multiple choice framework has a large impact on the percentage of students that correctly answer the problem. Results also suggest an increasing return to test format and calculator use/ type. Whereas in the case of the percentage change and data analysis problems, multiple choice had the largest impact, likely because students that have a sense of numeracy can analyze the possible answers and determine which answers are most likely correct when given multiple potential answers.

The layout of the rest of this paper is as follows. Section 2 gives a literature review. Section 3 describes the Algebra I Assessment. Section 4 describes the layout of the experiment. Section 5 summarizes the assessment results for those students that partook

in the experiment. Section 6 describes the empirical strategy. Section 7 presents results. Section 8 concludes.

I. Literature Review

The use of calculators in the learning of mathematics has been looked at for many years. The research is so vast that it will not all be discussed here. We will summarize some of the more recent results that have been found on the impact of calculators on SAT math questions and ignore the impact that calculators have on the acquisition of math skills, though we note that if calculator use does impact the acquisition of math skills that this could be causing a differential impact of calculator use on the ability of students to correctly answer SAT math questions.

Bridgeman, Harvey, and Braswell (1995) analyze the impact that calculator use has on the ability to correctly answer SAT math questions. They find that the benefit/cost of using a calculator depends on the type of SAT math question asked. The effect of calculator use on a student's ability to correctly answer a question ranged from positive through neutral to negative and that these range of effects were present in both difficult and easy questions. This follows our own results below. Scheunemanetal

Scheuneman et al (2002) evaluate questions included in the SAT math in 1996 and 1997 and find that students with better math skills are more likely to use a calculator and therefore score better.

Using ones own calculator may significantly impact a student's ability to correctly answer a SAT math question. Calculators vary in functionality and being familiar with a calculator yields benefits. Bridgeman and Potenza (1998) compare scores on SAT math questions when students use their own calculator versus an on-screen calculator. They find no impact of using the provided versus students' own calculators.

The impact of test format on test scores is another area of research that is vast, so again we will focus of the impact of test format on the ability of students to correctly answer SAT math questions as well as the impact on students ability to answer economics questions correctly. The SAT math contains questions that are both open-ended and multiple choice. From our research we have not found any analysis as to the difference in students performance on multiple choice vs. open ended questions in the SAT math. This may be because in the SAT math the questions that are asked using a multiple choice format are meant to assess students on different skills than those that are asked in an open-ended format. There is also no information available on scores from the SAT math on multiple choice versus non-multiple choice questions so it is difficult to analyze any impact on the actual exam.

Becker and Johnston (1999) look at the ability of multiple-choice and open-ended questions to evaluate students economic knowledge. Since the questions chosen from the SAT math in our assessment are chosen based off the skills necessary to do well in a principles of economic course, this research is pertinent. The authors find that both types

of questions show different dimensions of knowledge and so both could be used for testing in economics. Rebeck and Asarta (2012) find similar results.

From our search, we have not found any work that has been done on the interaction of calculator use and test format on students ability to answer SAT math questions or economics questions.

From our search, we have not found any other university that is requiring students to be take a test to evaluate them on their mathematical skills before entering principles of economics. In mathematics and the physical sciences, it is common for students to be assessed on their math skills before the beginning of a course. The Mathematics Diagnostic Exam is given to incoming mathematics students at New York Polytechnic. Bryan Mawr allows students to test their math readiness for a Physics course (though it is not required).

Many researchers have found that math skills are important to students performance in economics courses. Ballard and Johnson (2004) find that a student's acquisition of basic math skills is an important factor for performance in introductory microeconomics. Pozo and Stull (2006) run an experiment where the treatment group was given a grade incentive to complete a math skills unit. They find students in the treatment group performed better in the course than the control group. They also find a larger gain for students lower in the grade distribution. Lagerlof and Seltzer (2009) examine the impact of a remedial math course on students performance in economics, and find that though secondary mathematics has a great deal of explanatory power in determining how well a student does in economics, taking a remedial math course did bit demonstrate a positive effect. Mallik and Lodewijks (2010) look at the correlation of variables with students performance in economics. They find that high school math scores (beyond general math) have a positive correlation with students performance in economics. Owen (2012) does a review of additional findings that mathematical skills impact students performance in economics.

II. Algebra I Assessment

In Principles of Economics, Algebra I is considered to be a prerequisite at George Washington University. Whereas in the past GW economics professors have assumed that students were proficient in Algebra I, faculty members observed that students were weak in mathematics and this inhibited their learning of economics. It was for this reason that in the Fall of 2010, principles faculty began giving an Algebra I Assessment to all incoming principles of economics students that counts towards 10% of each student's grade, demonstrating the importance of Algebra I in the understand of principles courses.²

Students are told (by email) of the assessment 2 weeks before classes start and are told that the duration of the assessment is 30 minutes, that no calculators are to be used on the

² Students receive 10% if they pass on any of the attempts and 0% if they fail all three attempts.

assessment, and that the student must receive an 80% or higher to pass (as this demonstrates proficiency in Algebra I). The assessment is administered in students discussion sections with a respective teaching assistant for the course. Students are given 3 chances total to pass the assessment. The department provides remedial math support for all students that fail the first assessment given.

The layout of the Algebra I Assessment is as follows: 20 questions are chosen from the SAT Math that had a direct relationship to mathematical understanding in economics. Each question as well as a summary of how the question relates to economics is listed below in Table 1. Questions were chosen that were simple and could be easily done without the use of a calculator. The questions chosen covered the same topics as the SAT Math within the same proportions, including: Numerics and Operations (20-25%), Algebra and Functions (35-40%), Geometry and Measurement (25-30%), and Data Analysis (10-15%). A copy of the assessment is available upon request.

A total of 1,354 students took the Algebra I Assessment in the Fall of 2013. Of these students the average total score was 13.5/20 implying that on average students answered 68% of the 20 questions asked correctly. To pass students were required to correctly answer 80% of the question correctly, implying that a 16/20 or above was a passing score. This led to a failure rate of 65% on the first attempt at the assessment.

III. Experiment

Immediately after the Algebra I Assessment was given, 902 students³ from 2 professors of Principles of Microeconomics courses were given an Algebra I Questionnaire containing a sample of 10 questions from the Algebra I Assessment.⁴ This sample of students included the students of 13 teaching assistants where each teaching assistant had 3 discussion sections with approximately 25 students in each, implying that 39 discussion sections were sampled. Of these 902 students, 7% did not consent for their information to be used in the experiment, leaving us with 831 students in our sample. Table 1 demonstrates that the share of students that did not consent does not significantly differ across treatment and control groups. This ensures that there is no bias in the results from students not wanting to participate based off of their assignment into a specific treatment or control.

Figure 1 explains the experimental design. First, each teaching assistant was randomly assigned to a calculator treatment or control conditional on students' average SAT Math score. Randomization was first done at the teaching assistant level to ensure that treatment was followed as it would have caused students unneeded stress and would have been difficult to enforce if randomization was done by the discussion section or student. Each teaching assistant was also given a helper to ensure that each of the teaching

³ Of the 1144 students enrolled in the large principles of microeconomics courses 242 were dropped from the sample. These students were in a course with a professor who did not participate in the experiment. This could potentially bias our results in their application to all GWU students.

⁴ The sample of questions maintained the same proportions as the Algebra I Assessment and SAT Math.

assistant's classes would be strictly given the treatment or control. Randomization was conditional on the teaching assistant's students' average SAT Math score to ensure that treatment and control groups had similar math skill levels. Of the 39 discussion sections, 12 discussion sections (including 4 teaching assistants with 256 students) were assigned to the control group which did not have the use of a calculator, 9 discussion sections (3 teaching assistants) each were assigned calculator treatment in the form of being given a basic calculator at the beginning of the Algebra I Questionnaire, being given a TI-83 graphing calculator, or being allowed to use their own calculator.

The basic calculator used in this assessment were the same as those available to be used by the GW Economics faculty. Only addition, subtraction, multiplication, and division can be done with these calculators. There is no exponential function or square root. For students that were allocated into the treatment where they could use their own calculator, students were asked to report if the calculator was a basic calculator or graphing calculator. It was reported that 40% of students used a basic calculator, 56% used a graphing calculator, and 4% used no calculator. All students were advised previous to the assessment that they should bring a calculator, however it is likely that many students forgot the day of the assessment. It is for this reason that the results that are likely to be the most comparable from the Questionnaire to the SAT Math are those where students were given a graphing calculator as it is engrained in students that they should bring a graphing calculator to the SAT Math. It is also likely the most comparable because no checks were done for possible functions in students graphing calculators whereas the graphing calculators given to students had no functions downloaded onto them. The SAT Math checks all students calculators for downloaded functions.

To further test any interactions between calculator use and test format, we further randomize within each of the discussion sections (again conditional on students' SAT Math scores) such that half of students were given an open ended test framework and the other half of students were given a multiple choice framework. This was done by giving students an envelope with the assigned questionnaire inside.

The validity of the experimental design can be seen in Table 2, where statistically significant differences are tested between treatment and control groups. The only treatment group where students had a significantly lower SAT Math score in comparison to the control group was for those that received multiple choice and a graphing calculator (significant at the 10% level).

IV. Assessment Results for Experiment Participants

Assessment results for the 831 students that participated in the experiment can be found in Table 4. Of the 831 students that participated in the experiment their average total score on the Algebra I Assessment was 13.4/20 implying that on average students answered 67% of the 20 questions asked correctly. This led to a failure rate of 66% on the first attempt at the assessment.

Table 4 also gives the average total score on the assessment for these students if only the 10 questions used in the Questionnaire had been used on the Algebra I Assessment instead of the full set of 20 questions. The average total score if only these 10 questions had been used would have been 7.7/10 implying that on average students answered 77% of these 10 questions correctly on the assessment. This would have resulted in a failure rate of 61.5%. The reason for the difference in average score and failure rate between those questions chosen for the questionnaire and those used in the assessment is that only 22% of student correctly answered question 9 on the assessment (not used on the questionnaire).

Table 4 lastly gives the percentage of students that correctly answered each of the questions on the assessment as well as the corresponding question number on the questionnaire. Questions 2 and 4 from the assessment were used on the questionnaire and covered Numerics and Operations. On question 2 of the assessment, 89.6% of students answered the question correctly and on question 4 of the assessment, 96.8% of students answered the question correctly. Questions 7,8,10, and 12 from the assessment were used on the questionnaire and covered Algebra and Functions. 46.9% of students correctly answered question 7, 45.1% of students correctly answered question 8, 71.4% of students correctly answered question 10, and 62.5% of students correctly answered question 12. Questions 13, 14, and 17 from the assessment were used on the questionnaire and covered Geometry and Measurement. 55% of students correctly answered question 13, 80.9% of students correctly answered question 14, and 58.5% of students correctly answered question 17. Question 19 from the assessment was used on the questionnaire and covered Data Analysis. 63.3% of students correctly answered question 19.

V. Empirical Strategy

I Impact of Calculator Use in Open Ended Test Framework and Impact of Multiple Choice

To analyze the impact of each type of calculator (basic, graphing, and own calculator) in the open ended framework as well as the impact of using multiple choice instead of open ended framework, we use a difference in difference framework as follows:

$$y_i = \alpha + \beta\tau_i + \sum_{j=1}^4 (\delta_j T_{ij}) + \sum_{j=1}^4 (\gamma_j T_{ij}) * \tau_i + \epsilon_i \quad (1)$$

where i refers to student i , j refers to treatment group j (1 through 4 listed below), y_i is the score of student i (total out of 10 points and 0,1 for each question evaluated separately), $T_{i1} = 1$ if student i received multiple choice framework, $T_{i2} = 1$ if student i received a basic calculator, $T_{i3} = 1$ if student i received a graphing calculator, $T_{i4} = 1$ if student i was allowed to use his/her own calculator, where the control group is students that received the open ended test framework without the use of a calculator.

2. Impact of Calculator Use in Multiple Choice Framework

To analyze if there are any interactive impacts of using a calculator with multiple choice, we estimate the following equation:

$$y_i = \alpha + \beta\tau_i + \sum_{j=2}^4 (\delta_j T_{ij}) + \sum_{j=2}^4 (\gamma_j T_{ij}) * \tau_i + \epsilon_i \quad (2)$$

where i refers to student i , j refers to treatment group j (2 through 4 listed below), y_i is the score of student i (total out of 10 points and 0,1 for each question evaluated separately), $T_{i2} = 1$ if student i received a basic calculator, $T_{i3} = 1$ if student i received a graphing calculator, $T_{i4} = 1$ if student i was allowed to use his/her own calculator, where the control group is students that received the multiple choice test framework without the use of a calculator.

VI. Results

Results for the impact of calculator use and multiple choice format as well as the interaction between the two on students average total scores can be seen in Table 5 below. We find that allowing a student to use any calculator in an open ended test framework improves a student's score by .5-.6 of a point (or 5-6 percentage points) significant at the 1% level.⁵ We also find that introducing multiple choice improves a student's score by .9 of a point (or 9 percentage points), again significant at the 1% level. There is a statistically significant increase in a student's test score by an additional .5 points when introducing a graphing calculator in addition to the multiple choice framework (implying students that received multiple choice and a graphing calculator score 1.4 points higher- i.e. increasing their score by 14 percentage points-in comparison to those that received open ended framework without the use of a calculator). There is no statistically significant effect from introducing other forms of calculator in the multiple choice framework.⁶ The control group improved their score by .2 points (or 2 percentage points) implying that simply seeing the exam an additional time jogged students memories and yielded an improvement on their overall score.

Results for the impact of calculator use and multiple choice format as well as the interaction between the two on the percentage of students that answered each question correctly can be seen in Table 6 and 7 below. The most notable and interesting results are discussed here. Of the Numerics and Operations questions used in the questionnaire, question 1 asked students to calculate percentage change. Results from Table 6 demonstrate that giving students a basic calculator improves the percentage of students that answer correctly by 6.6 percentage points with no statistically significant effect from any other type of calculator. Giving students multiple choice improves the percentage of

⁵ There is no statistically significant difference between each type of calculator used.

⁶ Remember that only half of students brought their own graphing calculator implying that results where students use multiple choice and are given a graphing calculator are likely the most comparable to the SAT Math as almost all students bring graphing calculators to the SAT Math.

students that answer correctly by 8.5 percentage points. Originally, 90% of students correctly answered this question, therefore giving students multiple choice increases this to 98.5%. There is not statistically significant interactive impact from giving students a calculator in either test framework.

Of the Algebra and Functions questions used in the questionnaire, questions 3 and 5 are both algebraic word problems that require students to set up two equations and solve for two unknowns. We find that in question 3, giving students a calculator improves the percentage of students that answer correctly by 12-23 percentage points (with no statistically significant difference for each type of calculator). Originally, only 47% of students correctly answered this question, therefore giving students a calculator increases this to 59-70%. Giving students multiple choice improves the percentage of students that answer correctly by 21 percentage points, therefore increasing the percentage that correctly answer the problem from 47% to 68%. The impact from a calculator and multiple choice are similar. Analyzing the interaction between test framework and calculator use one can see that adding a graphing calculator to the multiple choice improves the percentage of students that correctly answer the problem by an additional 18 percentage points, thereby increasing the percentage of students that correctly answer the question from 68% to 86%. There is no significant effect from any other type of calculator.

For question 5, giving students a calculator improves the percentage of students that answer correctly by 7-10 percentage points (again with no statistically significant difference for each type of calculator). Originally, 71% of students correctly answered this question, therefore giving students a calculator increases this to 78-81%. Giving students multiple choice improves the percentage of students that answer correctly by 8 percentage points, therefore increasing the percentage that correctly answer the problem from 71% to 79%. Again the impact from giving student a calculator versus multiple choice are close. Analyzing the interaction between test framework and calculator use one can see that adding a graphing calculator to the multiple choice improves the percentage of students that correctly answer the problem by an additional 8 percentage points, thereby increasing the percentage of students that correctly answer the question from 79% to 87%. There is no significant effect from any other type of calculator. For question 5, by simply giving students the exam again there is an increase in the percentage of students that correctly answer the question by 4.5 percentage points.

The difference between results for questions 3 and 5 suggests a increasing return to calculators and multiple choice framework with increasing difficulty level. Question 3 was more difficult for students to answer and we can see a much larger impact of calculators and multiple choice for this question.

Of the Algebra and Functions questions used in the questionnaire question 6 asks students to calculate the minimum value of a function. Results from Table 7 show that giving students a calculator on this question improves the percentage of students that correctly answer the problem by 5-16 percentage points (with no statistically significant difference for each type of calculator). Originally, 63% of students correctly answered

this question, therefore giving students a calculator increases this to 68-79%. Giving students multiple choice improves the percentage of students that answer correctly by 10 percentage points, implying that the percentage of students that answer correctly would increase from 63% to 73%. There was no significant impact from adding a calculator to the multiple choice framework. Again there is little difference in the impact from having a calculator versus having multiple choice.

Of the Geometry and Measurement questions asked on the questionnaire, there was no statistically significant impact from giving students multiple choice or a calculator for question 7 where students are required to calculate the area of a pentagon. Considering that only 56% of students correctly answered this question this is an interesting result. For question 8, where students are asked for the slope of the line drawn, giving students the use of their own calculator improves the percentage of students that answer correctly by 8 percentage points, with no significant effect from any other calculators. This result could be due to the fact that students are familiar with the graphing properties of their own calculator. Giving students multiple choice test framework improves the percentage that answer the question correctly by 9 percentage points. Given that originally 81% answered the question correctly, this increases the percentage that answer correctly to 90%. There is no statistically significant interactive impact from calculator and multiple choice framework.

Lastly, in question 10, which covers the data analysis topic, we find that giving students multiple choice framework increased the percentage of students that answered correctly from 63% to 81% (an increase of 18 percentage points). There was no statistically significant impact from having a calculator and no interactive impact from having a calculator and multiple choice. By simply giving the students the exam again, there is an increase in the percentage of students that correctly answer the question by 9 percentage points.

This final question brings into question a serious qualm that people have with multiple choice. In this question, students were asked for the number of people represented by a share of the circle graph. The problem students had in the open ended framework was reading the question thoroughly. When originally answering the question on the assessment, many students simply put down the percentage of people represented by the share of the circle graph instead of the number of people. The share was .5 or 50% and students were required to find the number of people represented by that share when given the population. However, of the 4 possible choices in the multiple choice framework, 50 was not given as a choice. For students that received multiple choice, once they realized their answer was not there, they re-read the question. In economics, if you interpret a percentage as a value (for instance maybe an elasticity as a quantity or price) the answer is completely incorrect. In economics interpretation is key and giving students multiple choice does not allow for the testing of this interpretation.

VII. Conclusion

To conclude, we have verified our hypothesis that test format and calculator use are key contributors as to why the Algebra I Assessment is a better predictor of students performance in principles of economics than the SAT Math. This implies that if one is to implement a similar assessment he/she should be wary of using a multiple choice and/or allowing for the use of any calculator.

We find that calculator and test format have an impact on students overall scores, with an interactive impact from adding a graphing calculator to the multiple choice framework. As mentioned before this is likely the closest comparison group to the SAT Math.

We find that the impact of calculator use and test format varies depending on the type of question asked. For instance, in questions relating to Algebra and Functions where a word problem is used and students are expected to write out the functional form and solve for the two unknowns, calculator use and multiple choice alone have similar impacts, while adding a graphing calculator to the multiple choice framework has a large impact on the percentage of students that correctly answer the problem. Whereas in the case of the percentage change problem and data analysis problem, multiple choice had the largest impact, likely because students that have a sense of numeracy can analyze the possible answers and determine which answers are most likely correct when given multiple potential answers.

A basic math assessment that is open-ended and does not allow use of a calculator is a better predictor of student performance in a Principles of Economics course than SAT Math scores. Administering such an assessment will allow faculty to determine which students do not have the math ability to remain in the course and which students could take the course with some remedial help. Such assessment also gives students the correct signal about the rigor of the course. We emphasize the importance of making the assessment score a part of the course grade in order for students to take the math preparation seriously.

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Table 1

Question Number	Corresponding SAT Math Section	Representation as % in Algebra I Assessment	Representation as % in SAT Math	Relationship to Economics
1	Numerics and Operations	20.00%	20-25%	taxes
2	Numerics and Operations	20.00%	20-25%	growth rates; elasticity
3	Numerics and Operations	20.00%	20-25%	setting up demand or supply from word problem
4	Numerics and Operations	20.00%	20-25%	comparative statics; Solving for equilibrium
5	Algebra and Functions	40.00%	35-40%	Solving for equilibrium price or quantity; setting up demand or supply from word problem
6	Algebra and Functions	40.00%	35-40%	Solving for equilibrium ; 2 equations and 2 unknowns
7	Algebra and Functions	40.00%	35-40%	Solving for equilibrium; 2 equations and 2 unknowns
8	Algebra and Functions	40.00%	35-40%	Solving for demand/ inverse demand
9	Algebra and Functions	40.00%	35-40%	Cost function
10	Algebra and Functions	40.00%	35-40%	Solving for equilibrium; 2 equations and 2 unknowns
11	Algebra and Functions	40.00%	35-40%	Understanding supply equations
12	Algebra and Functions	40.00%	35-40%	Solving for minimum
13	Geometry and Measurement	30.00%	25-30%	Consumer/ Producer Surplus
14	Geometry and Measurement	30.00%	25-30%	Demand, supply, etc.
15	Geometry and Measurement	30.00%	25-30%	Demand, supply, etc.
16	Geometry and Measurement	30.00%	25-30%	Consumer Surplus
17	Geometry and Measurement	30.00%	25-30%	Change in consumer surplus, producer surplus, or national welfare
18	Geometry and Measurement	30.00%	25-30%	Demand, supply, etc.
19	Data Analysis	10.00%	10-15%	Using circle graphs to interpret data
20	Data Analysis	10.00%	10-15%	Cost Tables

Table 2

	<i>Difference between Multiple Choice No Calculator and Open Ended No Calculator</i>							
	<i>Difference between [...] and Open Ended No Calculator</i>				<i>Difference between [...] and Multiple Choice No Calculator</i>			
	1	2	3	4	5	6	7	8
Non-consent	0.056	0.026	0.033	0.03	0.017	-0.023	-0.034	-0.024
		(0.0307)	(0.033)	(0.033)	(0.031)	(0.034)	(0.033)	(0.034)

Table 3

Mean in Open Ended without calculator	<i>Difference between Multiple Choice without calculator and</i>		<i>Difference between [...] and</i>			<i>Difference between [...] and</i>		
	Open Ended without calculator	Open Ended with basic calculator	Open Ended without calculator		Multiple Choice without calculator			
			Open Ended with graphing calculator	Open Ended with own calculator	Multiple Choice with basic calculator	Multiple Choice with graphing calculator	Multiple Choice with own calculator	
1	2	3	4	5	6	7	8	
SAT Math	653	8.78 (9.5)	8.91 (10.15)	1.92 (10.27)	3.18 (10.55)	-7.37 (10.03)	-14.09* (10.2)	-13 (10.38)
ACT Math	28.52	-0.126 (0.83)	0.182 (0.777)	0.124 (0.85)	0.288 (0.75)	-0.295 (0.863)	-0.211 (0.809)	-0.35 (0.78)
% Female Students	0.53	0.048 (0.061)	0.009 (0.065)	0.067 (0.065)	0.029 (0.064)	0.054 (0.067)	0.053 (0.066)	0.029 (0.066)
% Students in Private High School	0.468	0.05 (0.06)	0.052 (0.065)	0.035 (0.065)	.1* (0.063)	-0.042 (.064)	-0.078 (0.064)	-0.078 (0.064)

		Table 4
Questionnaire	Assessment	
Question #	Question #	<i>Mean on the Assessment</i>
1	2	0.896
2	4	0.968
3	7	0.469
4	8	0.451
5	10	0.714
6	12	0.625
7	13	0.558
8	14	0.809
9	17	0.585
10	19	0.633
	Total Score (out of 10)	7.7
	Total Score (out of 20)	13.4
	Fail (=1 if fail) (out of 10)	0.615
	Fail (=1 if fail) (out of 20)	0.66

Table 5

		<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>		<i>Impact of Calculator use in Multiple Choice Framework</i>	
		A		B	
Multiple Choice	γ_1	.883*** (0.221)			
Basic Calculator	γ_2	0.602*** (.148)		.236 (0.213)	
Graphing Calculator	γ_3	.471*** (0.159)		0.46*** (0.137)	
Own Calculator	γ_4	.519*** (0.154)		0.218 (0.152)	
	β	.224* (.112)		1.1*** (0.128)	
	N	544		412	
	R ²	0.08		0.014	

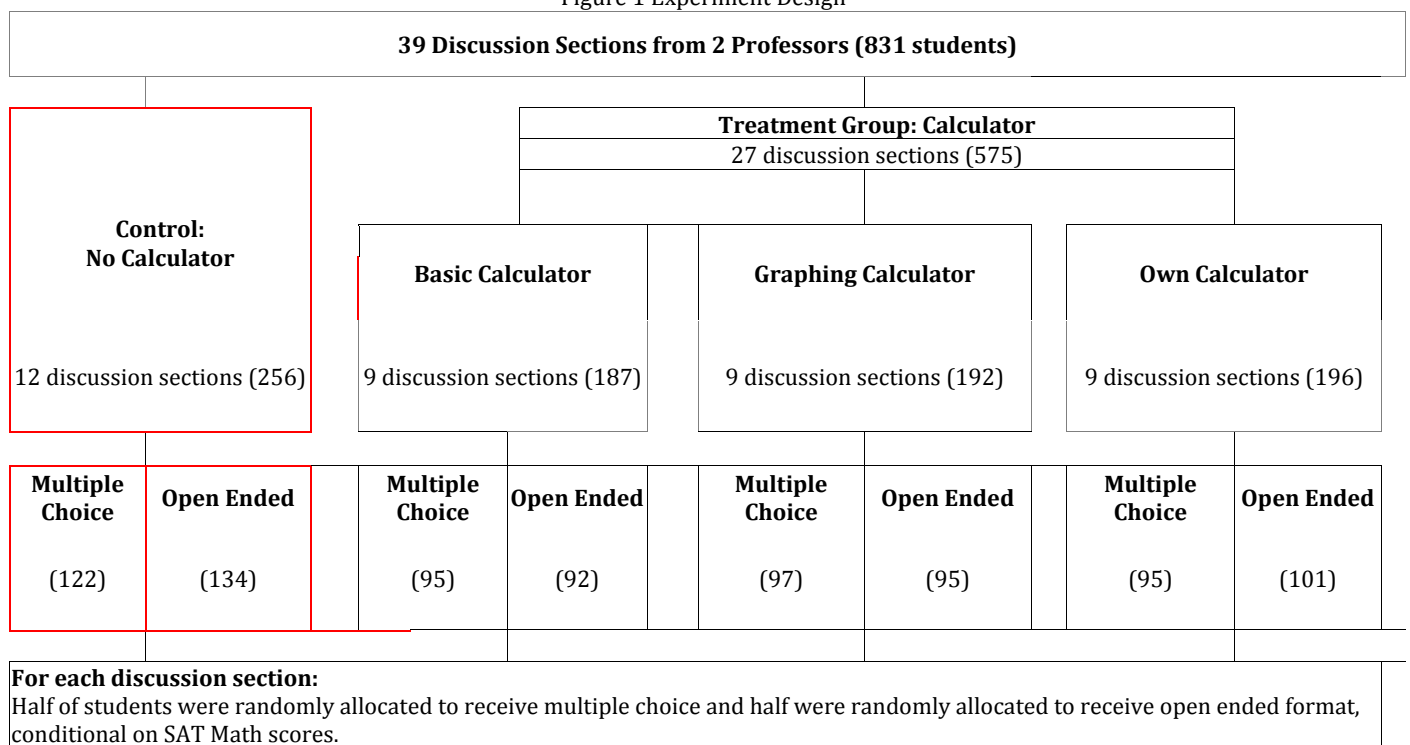
Table 6 Part I

		Question 1		Question 2		Question 3		Question 4		Question 5	
		<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>
		1A	1B	2A	2B	3A	3B	4A	4B	5A	5B
Multiple Choice	γ_1	.087* (0.048)		0.016 (0.025)		0.208*** (0.067)		0.046 (0.05)		.078*** (0.026)	
Basic Calculator	γ_2	.046 (0.046)	.053 (.037)	0.011 (0.01)	-0.016 (0.025)	0.231*** (0.051)	0.057 (0.11)	-0.034 (0.051)	0.035 (0.054)	0.075* (0.039)	0.035 (0.029)
Graphing Calculator	γ_3	0.048 (.029)	.038 (.033)	0.021** (0.009)	-0.027 (0.034)	.202*** (0.04)	0.18** (0.082)	-0.002 (0.035)	0.062 (0.061)	0.102*** (0.031)	0.081* (0.038)
Own Calculator	γ_4	.011 (.021)	.031 (.031)	0.02** (0.009)	0.015 (0.029)	.129** (0.048)	0.041 (0.075)	0.005 (0.033)	0.002 (0.041)	.094* (0.06)	0.011 (0.05)
	β	-0.011 (.016)	0.074 (0.023)	0 (0.025)	0.016 (0.025)	0.03 (.034)	0.238 (0.048)	0.045 (.033)	.091** (0.039)	.045*** (.012)	.123** (0.02)
	N	544	412	544	412	544	412	544	412	544	412
	R ²	0.03	0.013	0.005	0.014	0.05	0.019	0.01	0.003	0.014	0.006

Table 6 Part II

		Question 6		Question 7		Question 8		Question 9		Question 10	
		<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Calculator use in Multiple Choice Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	<i>Impact of Multiple Choice and Impact of Calculator use in Open Ended Framework</i>	
		6A	6B	7A	7B	8A	8B	9A	9B	10A	10B
Multiple Choice	γ_1	.106*** (0.016)		0.007 (0.059)		0.089** (0.034)		0.066 (0.095)		0.181*** (0.018)	
Basic Calculator	γ_2	0.046*** (0.015)	0.038 (0.028)	0.09 (0.055)	0.014 (0.039)	0.011 (0.025)	-0.03 (0.02)	0.106** (0.042)	0.097 (0.063)	0.008 (0.045)	0.056 (0.056)
Graphing Calculator	γ_3	0.118** (0.045)	0.044 (0.028)	0.005 (0.045)	-0.088 (0.084)	0.032 (0.024)	0.05 (0.039)	0.037 (0.048)	0.13* (0.067)	-0.068 (0.048)	-0.005 (0.02)
Own Calculator	γ_4	.161* (0.09)	0.108 (0.105)	-0.014 (0.046)	-0.001 (0.046)	0.081** (0.028)	0.025 (0.038)	-0.0004 (0.044)	-0.001 (0.068)	0.029 (0.025)	-0.005 (0.067)
	β	-0.007 (.012)	0.098 (0.022)	-0.052 (.039)	-0.045 (0.031)	-0.011 (.02)	.078*** (0.016)	.09** (.037)	0.156 (0.063)	.09*** (.018)	.27*** (0.016)
	N	544	412	544	412	544	411	544	412	544	412
	R ²	0.036	0.011	0.007	0.004	0.021	0.007	0.02	0.015	0.06	0.003

Figure 1 Experiment Design



Note: Number of students are in parenthesis.

USING NEWSVENDOR WITH MONTE CARLO SIMULATION TO OPTIMIZE ORDERING OF FLU VACCINES: A CASE STUDY

Rebecca A. Scott
University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403-5611
910-962-7533
scotra@uncw.edu

Stephen E. Hill
University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403-5611
910-962-3739
hills@uncw.edu

The newsvendor model allows for decision makers to calculate the optimal quantity of a perishable product that is to be ordered when demand is unknown. The model assumes a one-period planning horizon and that product is ordered and received prior to the beginning of this horizon. Inventory managers and other decision-makers in the healthcare industry often must order perishable biopharmaceuticals in advance of anticipated, but unknown demand. The perishability of the biopharmaceuticals creates a level of sensitivity to the amount of product desired by the medical facility. This paper presents a case study of the analysis of optimal inventory levels of flu vaccines at a medical facility using a newsvendor model. The objective of this model is to maintain appropriate customer service levels while maximizing profit. A portion of the case study is dedicated to examination of the newsvendor model assumptions. In particular, attention is paid to the selection of an appropriate probability distribution for demand. Six years of real-world, empirical data from a large, private medical physician's office is used. Monte Carlo simulation is demonstrated for comparison with the newsvendor model results. This research provides a pedagogical context for the use of the newsvendor model in the healthcare industry and highlights the analytical steps that can be undertaken when faced with the need to order quantities of perishable biopharmaceuticals, such as the flu vaccine. An important contribution of this work is demonstrating the pedagogical value of the application of quantitative models that can be implemented into industry with the potential to influence practice and the ordering methods used in medicine.

Teaching with Cases: Classroom and 'Online'
Sponsored by The Case Centre USA
Dr. Steve Leybourne, Boston University, sleyb@bu.edu
Eric Aldrich, The Case Centre USA, eric@thecasecentre.org

Have you recently started to teach with cases? Or maybe you have been teaching with cases for some time but would like to share and learn from others? Or perhaps you are an experienced professor who teaches and uses the Socratic method and you want to share and validate your approach.

In this session we will be talking about how you choose cases, how you engage your students, and we can also discuss how newer 'flipped classroom' ideas engage with case-based teaching.

We will also be looking at how cases can be used in 'online' courses, utilizing and building on the design and operation of courses at Boston University that have been delivered using a case-based approach over the last four years.

This will be a discussion-based session, and you will have the opportunity to ask questions and to network and share ideas with fellow participants.

The Facilitator

Dr. Steve Leybourne is a full-time professor at Boston University, where he teaches innovation and entrepreneurship, and teaches and researches in the project management domain. He has been engaged with case-based teaching for the last decade, and he co-designed the first online class at Boston University that is built around a case study pedagogy.

He is attached to Metropolitan College, which operates the majority of the online programs at BU, and where the online programs in Business have just been ranked #6 in the US by *US News & World Report*.

Application of principles from “The Goal” to Real Estate Operations

by

Richard Keller

Mount St Mary’s University

rakeller@email.msmary.edu

ABSTRACT

Operations in the real estate industry are rarely standardized, this is particularly so for real-estate agents. Analyzing the processes involved in this industry can yield significant benefits. This paper focuses on applying principles from the theory of constraints, as discussed in Goldratt’s book “The Goal”, to the real estate industry. This paper offers a practical perspective to improving ‘throughput’ in the real estate industry.

Keywords: Real Estate Operations, Theory of Constraints, The Goal, Bottlenecks.

1.0 Introduction

In 1984 Eliyahu Goldratt wrote the novel “The Goal”, which shares teachable principles and insights in manufacturing, using the Socratic Method (Dani, 2006; Narasimhan, 2005). Since its first edition over three decades ago, the principles applied are still relevant in this day and age (Dani,

2006; Stevenson, 2012). While this book is typically used to convey specific principles to professionals in the manufacturing industry, its reach extends far beyond the manufacturing context.

The purpose of this paper is to offer a practical perspective on how principles from “The Goal” can be applied to the real estate industry, specifically in regards to work carried out by real estate agents.

2.0 **Background**

2.1 Book overview

This book tells a story of a plant manager, Alex Rogo, who must find a way to save his company and his family from failure. Throughout this novel, the reader is taught process management principles intended for application in the manufacturing industry but their applications are not limited solely to one industry.

Alex Rogo learns the importance of determining the mission of an organization, and consequently assessing the performance of an organization by assessing its mission. In the manufacturing context, through a series of team discussion and self-reflection, Alex realizes that the goal of a business is to make money. From this, three process measures are used to assess the firm’s performance: throughput, inventory, and operational expense.

Critically, through a hike in the woods, Alex learns that the throughput of any process is solely determined by its bottleneck. The rest of the book is dedicated to the various challenges Alex faces with his team and the common-sense approach his team takes to addressing the bottlenecks that seem to pop-up all over.

Importantly, Alex learned that his family is important and so he needed to spend his time (resources) with them. To do this, Alex had to creatively think about his time and prioritize his family.

These principles can be transplanted into the real estate industry. In specific, the practical ideas I employed, in order of priority are: 1. Prioritize family time over work time. 2. Focus on processes leading to the end goal. 3. Find creative ways to remove bottlenecks and improve throughput.

2.2 Real-Estate Industry

The real estate industry is comprised of 190,000 residential and commercial companies operating in the brokerage and management field. In 2015, these companies generated \$200 billion in revenue (Real Estate Industry Analysis, 2015).

The U.S. Bureau of Labor Statistics shows that in 2012 there were 422,000 real estate agents and this number is expected to increase by 11% by the year 2022. With the diversity in markets, and many real estate agents operating as independent contractors, there is little to no process standardization in the industry. Real estate agents can find a myriad of different types of trainings, classes, and techniques which all claim to help agents become the best in their market segment. Unfortunately, none of these options are a one-size-fit-all magic pill for every agent in every market. Fortunately, the key principles taken from “The Goal” have universal application.

3.0 Main Content

3.1 What is the Goal?

In the book, Alex was asked by Jonah, his friend and advisor, to determine the goal of the company. Top level management at Rogo’s company emphasized efficiency as the goal. However, Alex soon realized that the end objective of any firm is to make money, and that productivity or market share are a means to this goal. Upon this realization, Alex realigned his manufacturing processes solely towards that goal. In the real estate business, making money is also the goal, and

while most real estate agents understand this, they do not focus their efforts on the processes that lead to this goal. Many real estate agents waste a lot of resources on activities that have minimal impact on those processes that result in making money.

As a real estate agent, I always knew that my goal was to earn as many commission checks as possible from the sale of real estate, but after reading this book I had to stop and analyze the processes that led to those checks. After working backwards from the goal, I realized that my process sequence is: Prospecting, Appointments, Presentations, Agency Agreements, Sales Contracts, and Settlements. Using the second principle of focusing on processes that lead to the end goal, I reprioritized my process activities.

As I focused on my sequence, I recognized recurrent time gaps between checks. To shorten these time gaps I had to first investigate why these gaps existed. I found that these time gaps existed because I was the only worker in my process, which made me the bottleneck of my business. For example, prospecting would lead to appointments and presentations, but when these processes filled up my schedule, along with the other processes of agency agreements and sales contracts, then I would stop the first step in my process (prospecting). After the entire sequence of processes were completed and the end goal was achieved, I would start again at the first process step of prospecting, and the cycle would start again. Since the process cycle with each client could last anywhere from sixty days to nine months, my bottleneck could be at any of the dependent processes. My goal had to change from making money to making money consistently, but to reach this new goal, my bottleneck problem had to be solved. This led me to realize I had to implement the third principle of finding creative ways to eliminate bottlenecks and improve my throughput.

3.2 Bottlenecks in the Real Estate Operation

In the book, Alex takes his son's Boy Scout troop on a hike and notices that a large boy named Herbie was slowing down the hike. One way Alex determined he could speed up the hike, or improve throughput, was to lighten Herbie's load by having others carry his backpack. By using the third principle in my own business, I tried to identify ways that I could take off my "Herbie backpack." I realized that I was performing some activities that did not require a real estate license and shifting this burden would improve my throughput.

Two specific areas I identified were photography and advertising for properties that I listed. I was not an expert in advertising or photography, and I knew I could identify people who were better than me, and critically, would cost less than what I was paying myself.

Additionally, I began to focus on clients who were sellers, as the return on my time was better than working with buyers. This was a way to maximize my time investment and, at the same time, these were potential clients that had skipped the prospecting step, starting at the 'appointment' stage in the process. This was a great development, because the time gaps between checks were due to time gaps between efforts in prospecting. By receiving leads that skipped the prospecting step, I was enjoying the results of prospecting without actually prospecting. If I could create a consistent flow of leads that would skip the prospecting step, which is equivalent to constant prospecting, this would in theory create a consistent flow of checks as well.

Operating under this theory, I purchased leads from an online vendor to create this consistent flow of leads that would start at the appointment step in my process. What I quickly realized was that the appointment step became my new bottleneck. I could not keep up with the demand and I needed to apply the third principle again. I decided to relieve my bottleneck by referring clients to other agents.

In real estate, an agent can refer a client lead to another agent and receive a 25% referral fee if it leads to a settlement. The problem with referring is that the agents who consistently have time to take a referral are usually bad agents or new agents. So when the bottleneck appeared at the appointment step in my process, the first client lead I referred was to a new agent and it was a failure. After analyzing what went wrong, I learned that the new agent was not adequately trained and this failure birthed a creative idea in my mind. New real estate agents want to be trained correctly and they need clients to get their business started, so I decided to train some new agents to be capable of turning client leads into settlements. This enables me to make passive income by helping others meet their goals, while simultaneously working towards my goal of smaller time gaps between checks.

3.3 Family & Real Estate Context

The first and most important principle taken from “The Goal” is to prioritize family time over work time; this principle is overarching because without it, every other area will suffer. In this narrative, the main character, Alex Rogo, prioritized his work over family time; his wife and two children rarely saw him. Many times when he was home, he was present only physically. This caused marital problems which eventually led to a separation, with all four members of the family grieving over the emotional and physical upheaval in their lives. While the story in this book had a happy ending, a home life that has one person consistently putting work over family will eventually, at best, cause instability at home. At worst, it will cause devastation to all family members.

In the real estate context, agents have the flexibility to make their own schedule as independent contractors. In theory, this might make it seem easy for them to apply the last principle. However, in reality, it is more difficult than a traditional job with set hours. The difficulty arises

from real estate clients being available only at certain times, offers coming in at any hour, every phone call potentially being a new client, and no set ending time for appointments.

Real estate clients are either home owners or potential home owners. In either case, an income is usually required. This means that real estate clients are available when they are not working, which is usually when an agent's spouse and children are available from school and work. This results in real estate agents having to make daily scheduling decisions pitting work time against family time. Another difficulty in prioritizing is that phone calls can come in at any time. These phone calls could be a contract offer or a new client lead, both of which are time sensitive. Contract offers allow only a certain time frame for acceptance and if an agent does not answer the phone to accept a client lead, that lead will go to another agent. This puts enormous pressure on real estate agents to answer their phone during family time. If this is not bad enough, real estate agents cannot predict how long each appointment will take. If a client is extremely verbose or inquisitive, it could take hours longer than expected, as compared to a normal nine-to-five job where closing time is more specific. It is easy to see why real estate agents tend to have trouble prioritizing family time over work time, but it can be done.

As a real estate agent entering into my third year of business, the way I prioritize family time over work time is to predetermine a certain amount of time to spend with family each week and schedule family time appointments. I schedule one weekday with my four year old daughter, three evenings a week to be with my wife, and one weekday after school I spend with my ten year old son. Additionally, I schedule one day each weekend to spend together with my family. It means that I will not answer my phone for the entire day or that I will not schedule a meeting with a client during that time period., Prioritizing family time over work time creates less work schedule flexibility, **which makes application of the other two principles a necessity.**

5.0 Conclusion

Although the real estate industry is significantly different from the manufacturing industry, the principles in Goldratt's novel, "The Goal", can be successfully applied to real estate, as I have successfully done in my real estate business. These three principles, when applied and correctly prioritized, will allow for a fulfilling and successful life at work and at home.

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The Relationships between Culture, Leader-Member Exchange Quality, and Job Satisfaction of Vietnamese Employees

Abstract

Experienced human resource professionals recognize the importance of maintaining and promoting employees' job satisfaction in talent management and retention. Scholars have done extensive research on job satisfaction of workers in developing economies in the North America and Western Europe. However, there is limited research done about workers in developing countries, specifically workers in contemporary Vietnam. The paper investigates Hofstede's six cultural dimensions of Vietnamese employees on individual levels. The paper aims to study the relationships between individual cultural dimensions and the quality of the leader-member exchange, and the leader-member exchange quality and job satisfaction of Vietnamese employees. Studying the influence of culture on job satisfaction of workers in developing nations is important for both domestic and international managers. Managerial implications, limitations, and future research are also discussed.

Keywords: culture, cultural dimensions, leader-member exchange, job satisfaction, Vietnamese employees

INTRODUCTION

Vietnam is an attractive market with large target market combining with “low-cost production sites” and young and energetic labor force (Meyer, Tran, & Nguyen, 2006). With over 60% of the population in the workforce and more are getting into the domestic and international business environment, it is important for leaders to know their employees’ well-being including job satisfaction to enhance job performance and productivity. Measuring and maintaining employees’ job satisfaction benefit in numerous ways including employees’ job performance, organizational citizenship behavior (subordinates’ positive outlook on the organization, co-workers, and the job itself), customer satisfaction, absenteeism, turnover, and workplace deviance (Fu & Deshpande, 2014; Bouchkenooghe, Raja, & Butt, 2013; Quedraogo & Leclerc, 2013; Dello Russo, Vecchione, & Borgogni, 2013). Active (“leaving the organization”) or passive (“passively allows conditions to worsen”) reactions to job dissatisfaction can be majorly destructive (Robbins & Judge, 2013). This study links the cultural aspects, Hofstede’ cultural dimensions in particular, to the relationship between supervisors and employees and their job satisfaction.

Culture is the “traditional (i.e. historically derived and selected) ideas and especially their attached values” (Kluckhohn, 1951) and “interactive aggregate of common characteristics that influence a human group’s response to its environment” (Hofstede G. H., 1984). Many researchers have studied the relationships between a country’s culture and its other aspects such as health (Iwelunmor, Newsome, & Airhihenbuwa, 2014), communication (Miulescu, 2014; Horner, 2011), education (Capatina, 2015; Farah & Steiner-Khamsi, 2014), psychology (Williams, Chairrot, Capili, McDonald, & Cresswell, 2014; Lehman, Chiu, & Schaller, 2004), and especially business (Claus, Callahan, & Sandlin, 2013; Russette, Scully, & Preziosi, 2008;

Halkos & Tzeremes, 2008). Researchers have studied the numerous effects of culture on many facets business such as organizational or individual work performance (Leach-Lopez, 2013; Duff, Tahbaz, & Chan, 2012), ethics (Gift, Gift, & Zheng, 2013; Li & Persons, 2011; Scholtens & Dam, 2007), and organizational citizenship behavior (Ersoy, Born, Derous, & Molen, 2012). These studies have helped international business leaders comprehend their diverse work force. Each culture, greatly influenced by their traditions and customers, has their own business methods in trying to achieve the bottom line. By distinguishing Hofstede's cultural dimensions such as individualism/collectivism, masculinity/femininity, long-/short-term orientation, power distance, and uncertainty avoidance, studies have given business leaders broad and detailed guidelines of what was expected in different business environments (Yacout & Hefny, 2015; Musabira & Matusitz, 2015; Manrai & Manrai, 2011).

As many as studies about different business aspects in Vietnam (Malesky, Gueorguiev, & Jensen, 2015; Pincus, 2015; Cox, Hannif, & Rowley, 2014; Meyer et al., 2006; Han & Baumgarte, 2000), there is still a need to measure Vietnamese workers' job satisfaction and the causes of their job satisfaction. One of the few studies to address employees' satisfaction is Duong's study (2013) about the "factors that affected the job satisfaction of ... 178 academic members from three public universities of Ho Chi Minh City in Vietnam" (p. 346). However, the study only focuses on the specific group of higher educators and does not address the influence of culture on each indicator of job satisfaction. This paper studies the general population of the workforce: office employees in public and private companies. This paper aims to study the relationship between employees' individual levels of Hofstede's five cultural dimensions: power distance, collectivism/individualism, masculinity/femininity, uncertainty avoidance, and long-

term orientation, and the quality of leader-member exchange, in turn affecting the employees' job satisfaction.

This study is significant because of its target participants (Vietnamese millennials as majority of their workforce) and timely approach in the contemporary and ever-changing Vietnam. With previous valuable knowledge on cultural effects on business practices, this study verifies its accuracy and deepens its clarification. With the new findings, organizations can define their businesses' core values, mission, vision, codes of conducts to better serve their internal customers, and satisfy their contemporary necessities and wishes. Most importantly, middle-level and first-line managers can understand their subordinates' new personal and organizational behaviors, and correspondingly adjust their leadership styles. This study aids business practices domestically: for domestic managers to adjust and improve their business conducts to their young employees, and internationally: for international managers to know what to expect, learn from, and choose the best approach to work and communicate effectively with their domestic counterparts and subordinates.

The purpose of this research is to help domestic and international managers and business leaders adjust their business practices and improve their interpersonal and profession relationships with their subordinates to accommodate the young and energetic workforce of contemporary Vietnam. The theoretical framework (figure 1) highlights the positive or negative relationships between each cultural dimension (power distance, collectivism, masculinity, uncertainty avoidance, and long-term orientation) and leader-member exchange quality, in turn affecting subordinates' overall job satisfaction. Vietnamese participants are surveyed to measure their individual levels of cultural dimensions, quality of their leader-member exchange, and job satisfaction (survey instruments are included in Appendix A).

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This section details literature review on leader-member exchange theory and five Hofstede's cultural dimensions of power distance, individualism/collectivism, masculinity/femininity, uncertainty avoidance, long-/short-term orientation, and indulgence. This section also proposes a conceptual framework of the influence of culture on leader-member exchange quality and job satisfaction.

Leader-Member Exchange (LMX) Theory

When first introduced by Dansereau, Graen, & Haga (1975), LMX theory was called the vertical dyad linkage theory to emphasize the “dyadic relationship” between a leader and a follower. The quality of dyadic relationship with the leader, is based on the leader and the member's “personality and other personal characteristics” and “how well they work with the leader and how well the leader works with them,” classifies a subordinate as an in-group or an out-group (Northhouse, 2013; Dansereau et al., 1975). In-group subordinates are willing to go beyond their “formal employment contract (defined roles)” to take on extra tasks, stay late to finish a project on time or early, give more input in a project or an issue (Northhouse, 2013). To a leader, in-group subordinates definitely appear more favorably; hence the leader will reciprocate by giving in-group subordinates more resources, entrusting them with more important and possibly more rewarding projects, the leader and the subordinate recognize the “mutual obligation” to each other (Graen & Uhl-Bien, 1995). On the other hand, out-group subordinates affix to their job description, come to work just to do their tasks, much less involved nor willing to invest in anything more than their contract. The theory later shifted focus from the in-group and the out-group to the significance of quality of the relationship to organizational outcomes (Graen & Uhl-

Bien, 1995). The relationship now is classified as high or low quality leader-member exchange. The leader-member exchange quality variable in this research is also graded as high or low.

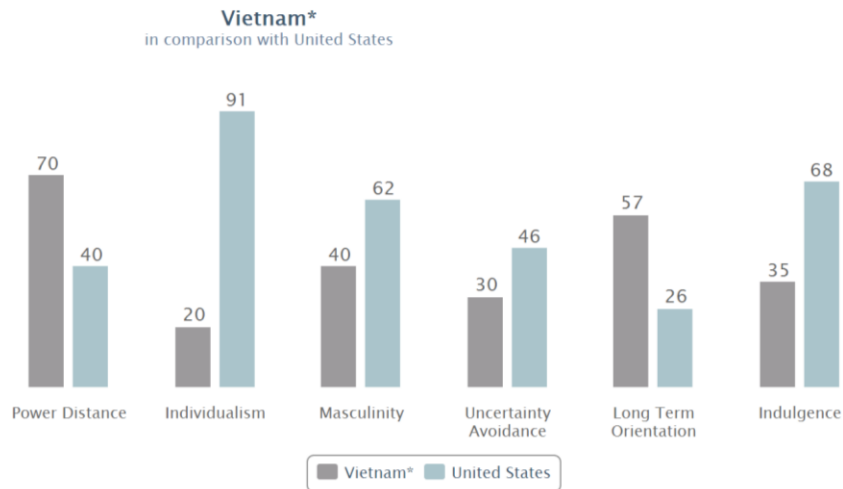
Power Distance

Within the context of an organization, power distance is defined as the acceptable amount of unevenly distributed power, or “inequality” between managers and employees (Hofstede G. , 2011). Managers and employees, or leaders and members, in organizations with small power distance actively and directly participate in decisions making, share information, and work together to accomplish day-to-day goals (Hofstede G. H., 1984). Usually their “communication [channel] is informal” and every person’s voice matters. In contrast, organizations with large power distance are highly centralized and have clear organizational structures (Vietnam).

Sweetman (2012) emphasized the negative effects of large power distance on “the multiple-level relationships and open communication required for innovation” in “many Asian-headquartered corporations.” Figure 1 illustrates cultural dimensions’ scores of Vietnam (in gray bars) in comparison with the United States (in blue bars). With a score of 70, Vietnamese have high acceptance for large power distance like many other Asian and Middle Eastern countries, which means leaders and members in Vietnam know their places and act accordingly to their legitimate power and official status. This is because, “In large power distance cultures, everyone has his or her rightful place in a social hierarchy” (Mooij & Hofstede, 2011, p. 182). The moment a leader and a member accept the unevenly distributed power between them, the supervisor sets interpersonal boundary with that subordinate. This means the leader and the member agree to a mental contract in which the subordinate acknowledges and abide to the supervisor’s power and authority. Following their professional relationship, the personal relationship between the leader and the member also leans towards the acceptance of the power difference.

H1: *The larger the power distance between a leader and a member, the poorer the leader-member exchange quality.*

Figure 1. Cultural Dimensions' Score of Vietnam and the U.S.¹



Individualism/Collectivism

Individualism “describes the relationship between the individual and the collectivity which prevails in a given society” (Hofstede G. H., 1984, p. 148). People who identify themselves as individualists “think for themselves” and act upon their uniqueness to achieve tasks and goals in the workplace (Country Comparison - United Kingdom). Employees, even when working in teams, are expected to be independent and proactive; hence most bonuses, raises, promotions are rewarded individually based on each employee’s performance. Contrarily, countries that possess collectivistic characteristics are family-like where everyone works for the greater good of the whole, not just himself or herself (Hofstede G. , 2011). Mooij and Hofstede (2011) distinguished individualism and collectivism by pointing the consciousness in the “I” and the “we”

¹ Source: The Hofstede’s Center, <http://geert-hofstede.com/vietnam.html>

respectively. While organizations in collectivist countries are highly task-oriented, close interpersonal relationships and interactions are more appreciated; therefore, everyone wants to belong and be accepted by their superiors and peers. “Preserving harmony and avoiding loss of face” for themselves and for others, is strongly encouraged and appreciated in collectivist cultures (Mooij & Hofstede, 2011). Once an employee feels like he or she has become a part of the work family, that person is exceedingly committed and loyal to the organization and the work itself. Individualists value “self-reliance,” their own capabilities, interests, and personal accomplishment; while collectivists emphasize the importance of the “group” to each individual in terms of belonging, relations, achievement, conformity (Hsu, 1983; Ho & Chiu, 1994). Individualism/Collectivism can be “reflected in the way people live together” (Hofstede G. H., 1984, p. 148). Markus and Kitayama (1991) highlighted “the fundamental relatedness of individuals to each other” of people with high level of collectivism (dominantly Asian cultures). On the other hand, in individualist cultures such as American, such “overt connectedness” is unappreciated. People in individualist cultures would rather remain independent and unattached to others while people in collectivist cultures “stress on belonging” (Hofstede G. , 2011). In individualist cultures, “task prevails over relationship,” while in collectivist cultures, relationship triumphs over task (Mooij & Hofstede, 2011). Regardless of interpersonal or strictly professional relationships between a leader and a member, such individualist behaviors lead to the second hypothesis.

H2: The greater the member’s level of collectivism, the greater the leader-member exchange quality.

Masculinity/Femininity

Masculinity and femininity dimensions refer to “what motivates people” (Vietnam, n.d.). Employees of masculine countries strive to be on top of their fields and are proud of their personal “successes and achievements in life.” These masculine cultures are often referred, as “winner takes all.” In contrast, employees in feminine cultures act and work with a modest and harmonic approach. Femininity dimension is much aligned with the low power distance dimension where employees emphasize the organization’s achievements rather their own. Another distinguishing characteristic between masculine and feminine cultures is the “male and female roles” (Mooij & Hofstede, 2011). In masculine cultures, men assume the responsibilities of making and bringing home the money, or hold jobs that were more male-dominated, while women work in professions that are female-dominated and undertake household responsibilities. Oppositely, in feminine cultures, such assumption is not recognized, men and women share the household responsibilities, and do not dreadfully underline the gender aspect in job preferences (Mooij & Hofstede, 2011). Similar with individualists, subordinates with high level of masculinity not only strive to be different from every else, but also to rise above and be on the very top. In addition, along the process of striving on top, subordinates or members with high level of masculinity might challenge their leader’s official authority and power. The masculine characteristics illustrate those of the performance orientated. A person who is performance orientated works to prove his or her “superiority over others,” in turn, suspend the relationship with his or her leader (Janssen & Yperen, 2004).

H3: The greater the subordinates’ masculinity, the poorer the leader-member exchange.

Uncertainty Avoidance

Uncertainty avoidance refers to “the extent to which people feel threatened by uncertainty and ambiguity and try to avoid these situations” (Mooij & Hofstede, 2011, p. 183). With a low score

of 30, Vietnamese are open to ambiguity, new changes, or innovation. Vietnamese value practicality more than fixed and unnecessary rules, which means there is always room for new learning opportunities and experience (Vietnam, n.d.). Subordinates with high level of uncertainty avoidance are those who fear the unknown and unstructured. They are bounded by the need of knowing what will work and what will not, what will succeed and what will not. Baker and Carson (2011) stated that subordinates with high levels of uncertainty avoidance actively seek to “[attach] themselves to the dominant [work] groups ... and modeling behavior after group norms,” in hope of being accepted, and avoiding uncertainty of the surrounding environment and arising problems. Clugston, Howell, and Dorfman (2000) stated, “The high aversion of risk coupled with the fear of loss of security suggests that attachments are based on feelings of having to stay in relationships” (p. 23). Therefore, they will maintain the harmonic relationship with their leader to minimize the chances of facing uncertainty and running into the unexpected.

H4: The greater the member’s uncertainty avoidance, the greater the leader-member exchange quality.

Long-/Short-Term Orientation

Long-term orientation presents “the extent to which a society exhibits a pragmatic future-oriented perspective rather than a conventional historic or short-term point of view” and “how every society has to maintain some links with its own past while dealing with the challenges of the present and future” (Vietnam, n.d.; Mooij & Hofstede, 2011, p. 183). Hofstede considered Vietnam, with a moderate long-term orientation score of 57, a “pragmatic culture,” in which people show understanding towards change while working hard and saving for the future. Organizations and employees in countries with high long-term orientation score believe in the

long-term sustainability and stability of the whole organization and act accordingly to maintain such goal. In a study by Luczak, Mohan-Neill, and Hills (2014) comparing the effects of cultures on business conducts of Indian and American business owners found that comparing to their American counterparts, Indian business owners, who possess long-term orientation, are future-oriented which means they work in a way that preserves to the long-term success and relationships.

Hofstede and Minkov (2010) showed that countries that are short-term orientated (goals are set to be achieved in short periods) are also individualistic and indulgent in which people's "main work values are freedom, rights, achievement, and thinking for oneself." "Old age" was interestingly discussed as favorable or unfavorable in the long-term and short-term orientated cultures respectively (p. 469, 467). Most importantly, Hofstede and Minkov (2010) concluded that "people's ways of thinking are culturally constrained" which means the same person born and grown up in two different cultures could have different sets of values and beliefs. Luczak, Mohan-Neill and Hills (2014) stated, in one of his earliest studies, Hofstede (1991) also linked individualism and collectivism with masculinity and femininity respectively. Managers and employees in collective and feminist cultures make business decisions and deliver their work in tribute "to the formulation of cultural norms and values." As subordinates with long-term orientation strive for stability and sustainability, they will aim to maintain a harmonic and beneficial relationship with their supervisors and colleagues. The professional and personal relationship between a leader and a member could also be on the ground that both parties believe in longevity and other related longevity-based beliefs.

H5: The greater a member's long-term orientation, the better the leader-member exchange quality.

Indulgence/Restraint

Indulgence refers to “the extent to which people try to control their desires and impulses, based on the way they were raised” (The Hofstede's Center, n.d.). In restraint cultures such as Vietnam, subordinates “do not put much emphasis on leisure time and control the gratification of their desires [as they are] restrained by social norms and feel that indulging themselves is somewhat wrong” (The Hofstede's Center, n.d.). On the other hands, subordinates with high level of self-indulgence enjoy taking care of themselves outside of work and invest in their leisure times. These subordinates are also likely to do it with their colleagues and even invite their supervisor to join such events.

H6: The greater the subordinates' level of self-indulgence, the greater the relationship between the supervisor and the subordinates.

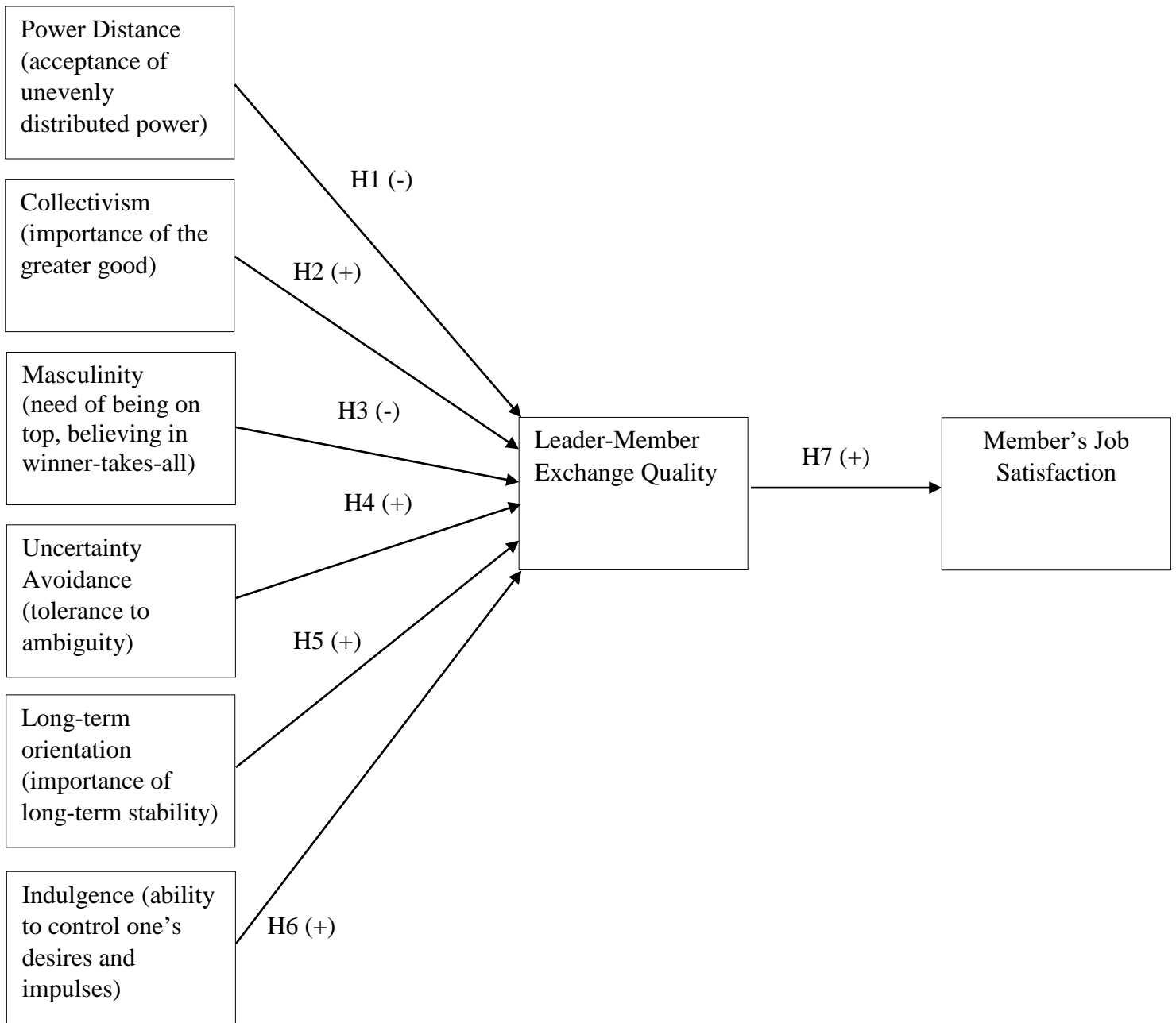
Leader-Member Exchange Quality and Job Satisfaction

Job satisfaction refers to the “positive feeling about a job, resulting from an evaluation of its characteristics” (Robbins & Judge, 2013, p. 74). Some grounds of job satisfaction include the job itself such as “training, variety, independence, and control ... [and] interdependence, feedback, social support, and interaction with co-workers outside the workplace” (Robbins & Judge, 2013, p. 81). Pay does affect job satisfaction but mostly only applicable to workers in poor countries. As a member works directly with their supervisor or leader on a daily basis, the quality of their exchange plays a major role in determining how the job is done and evaluated by the supervisor. Janseen and Yperen (2004) concluded “a lower quality of leader-member exchange was associated ... with lower job satisfaction” (p. 379). On the other hand, high quality leader-member exchange is positively related to members' job satisfaction (Graen & Uhl-Bien, 1995;

Monahan, 2013). Approaching from a social identity standpoint, Loi, Chan, and Lam (2014) proved the indirect but positively relationship between leader-member exchange quality and job satisfaction through the mediating role of organizational identification. Vukonjanski, Nikolic, Olga Hadžic, Terek, Nedeljkovic (2012) studied and proved the significant “the relationships between the GLOBE [(Global Leadership and Organizational Behavior)] organizational culture dimensions, facets of job satisfaction and the leader-member exchange relation in Serbian organizations.” GLOBE organizational dimensions (House, Hanges, Javidan, Dorfman, & Gupta, 2004), based on and extended from Hofstede’s cultural dimensions, focus more on the organizational aspects of individuals than the cultural. These dimensions include uncertainty avoidance, future orientation, power distance, institutional collectivism, humane orientation, performance orientation, in-group collectivism, gender egalitarianism, and assertiveness. Overall, it is safe to hypothesize that the member’s job satisfaction can be positively affected by the quality of the exchange with his or her leader.

***H7:** Leader-member exchange quality is positively related to the member’s job satisfaction.*

Figure 2. The Relationships between Culture, Leader-Member Exchange Quality, and Job Satisfaction



RESULTS

One hundred and four Vietnamese participants were surveyed using scales including power distance, masculinity, collectivism, uncertainty avoidance, long-term orientation, and a background information form (see Appendix A). Data was analyzed using partial least squares (PLS), and more specifically SmartPLS version 2.0 (Ringle et al., 2005), tables 2 and 3 were produced.

Table 1
Demographics of Respondents

	Percentage of respondents
Gender	
Female	51.08%
Male	48.92%
Age	
18 to 23	13.46%
24 to 29	63.35%
30 to 35	9.62%
36 to 41	5.77%
42 to 47	3.96%
48 to 53	1.92%
54 to 59	1.92%
Highest Education	
High School Diploma/GED	11.54%
Two-year Degree	25.00%
Bachelor's	51.92%
Master's	10.58%
Ph.D.	.96%
Working Status	
Full-time	77.88%
Part-time	22.12%

Table 2
Overview of indicators and measures of reliability and validity

Constructs and indicators	Outer loadings	
	Point estimation	<i>t</i> -value
Power Distance ($\alpha = .63$, AVE = .22, CR = .29)		
P1 People in higher positions should make most decisions without consulting people in lower positions.	.731	2.140
P2	-.332	1.084

	People in higher positions should not ask the opinions of people in lower positions too frequently.		
P3	People in higher positions should avoid social interaction with people in lower positions.	.524	2.212
P4	People in lower positions should not disagree with decisions by people in higher positions.	-.057	.256
P5	People in higher positions should not delegate important tasks to people in lower positions.	.409	2.053
Collectivism ($\alpha = .73$, AVE = .15, CR = .04)			
C1	Individuals should sacrifice self-interest for the group.	.108	.432
C2	Individuals should stick with the group even through difficulties.	.740	1.544
C3	Group welfare is more important than individual rewards.	.280	1.016
C4	Group success is more important than individual success.	.054	.204
C5	Group loyalty should be encouraged even if individual goals suffer.	-.210	.607
C6	Group loyalty should be encouraged even if individual goals suffer.	-.488	1/043
Masculinity ($\alpha = .70$, AVE = .46, CR = .76)			
M1	It is more important for men to have a professional career than it is for women.	.519	3.523
M2	Men usually solve problems with logical analysis; women usually solve problems with intuition.	.484	2.815
M3	Solving difficult problems usually requires an active, forcible approach, which is typical of men.	.708	5.283
M4	There are some jobs that a man can always do better than a woman.	.912	11.969
Uncertainty Avoidance ($\alpha = .85$, AVE = .60, CR = .88)			
UA1	It is important to have instructions spelled out in detail so that I always know what I'm expected to do.	.655	11.263
UA2	It is important to closely follow instructions and procedures.	.824	30.199
UA3	Rules and regulations are important because they inform me of what is expected of me.	.861	47.721
UA4	Standardized work procedures are helpful.	.820	26.573
UA5	Instructions for operations are important.	.703	11.192
Long-term Orientation ($\alpha = .71$, AVE = .40, CR = .79)			
LO1	I believe in careful management of money (thrift).	.490	7.976
LO2	I believe in going on resolutely in spite of opposition (persistence).	.733	14.279
LO3	I believe in personal steadiness and stability.	.788	22.161
LO4	I believe in long-term planning.	.645	9.562
LO5	I believe in giving up today's fun for cusses in the future.	.506	6.343
LO6	I believe working hard to success in the future.	.560	8.052
Indulgence ($\alpha = .50$, AVE = .30, CR = .63)			
ID1	I believe in personal life control.	.940	12.525
ID2	Freedom of speech is important.	.701	7.214
ID3	Leisure is highly important.	.194	1.436
ID4	I remember positive emotions.	.576	5.266
ID5	More people should be actively involved in sports.	.189	1.473
ID6	Maintaining order in the nation is not a high priority.	.090	.783
Leader-Member Exchange ($\alpha = .88$, AVE = .67, CR = .91)			

LMX1	You know where you stand with your supervisor and you usually know how satisfied your supervisor is with what you do.	.714	26.644
LMX2	Your supervisor understands your job problems and needs.	.834	55.440
LMX3	Your supervisor recognizes your potential.	.856	51.402
LMX4	I have enough confidence in my supervisor that I would defend and justify his or her decision if he or she were not present to do so.	.824	47.186
LMX5	Your working relationship with your supervisor is effective.	.863	54.700
Job Satisfaction ($\alpha = .85$, AVE = .43, CR = .88)			
JS1	The way my boss handles his/her workers.	.794	44.069
JS2	The competence of my supervisor in making decisions.	.703	34.294
JS3	The way my job provides for steady employment.	.757	25.230
JS4	The chance to do something that makes use of my abilities.	.723	19.921
JS5	My pay and the amount of work I do.	.650	14.031
JS6	The chance for advancement on this job.	.555	31.858
JS7	The working conditions.	.757	7.880
JS8	The way my coworkers get along with each other.	.458	5.242
JS9	The praise I get for doing a good job.	.323	20.807
J10	The feelings of accomplishment I get from my job.	.678	22.872

α – Cronbach’s alpha; AVE – average variance explained; CR – composite reliability.

Table 3
Latent Variable Correlations

Construct	PD	C	M	UA	LO	ID	LMX	JS
Power Distance (PD)		-.06	-.19	.17	.20	.08	.33	.13
Collectivism (C)			.17	.16	.01	.18	.12	.02
Masculinity (M)				-.07	-.16	.05	-.22	-.22
Uncertainty Avoidance (UA)					.31	.28	.31	.21
Long-term Orientation (LO)						.35	.30	.13
Indulgence (ID)							.33	.05
Leader-member Exchange (LMX)								.70
Job Satisfaction (JS)								1.00

Table 4
Path coefficients and R^2 of structural model

Constructs and indicators	Path coefficients		Hypotheses	
	Point estimate	t-Value		
LMX ($R^2=.28$)				
PD	.238	1.848*	H1	Supported
C	.101	.833	H2	Rejected
M	-0.179	4.557***	H3	Supported
UA	.144	4.266***	H4	Supported
LTO	.097	1.978**	H5	Supported
ID	.229	5.493***	H6	Supported
JS ($R^2=.49$)				
LMX	.700	31.255***	H7	Supported

* $p < .10$, ** $p < .05$, *** $p < .01$

DISCUSSION

Results supported hypotheses one, three, four, five, six, and seven. At the 90% confidence level, the positive relationship between power distance and LMX is significant. Unlike hypothesis one, which predicted the inverse relationship between PD and LMX, results showed Vietnamese workers who accept and are in a relatively high PD environment do have a high quality exchange with their supervisors or leaders. This may be because as in a high PD culture like Vietnam, workers expect certain level of PD, as it is the norm; hence maintaining such PD may actually increase the quality of LMX (Mooij & Hofstede, 2011). At the 95% confidence level, the direct relationship between long-term orientation and LMX is significant. The positive relationships between uncertainty avoidance and LMX, and indulgence and LMX are significant at the 99% confidence level. Employees who exhibit high levels of long-term orientation and uncertainty avoidance have high exchange quality with their supervisors. This can be explained by the fact that these employees value long-term relationships, harmony, and want to avoid uncertainty and ambiguity; hence, they will clearly want to maintain a high level of exchange with their supervisors, especially in an expected circumstance. Employees who are high on indulgence, meaning they have weak “control [over] their own desires and impulses,” also have high exchange quality with their supervisors (The Hofstede's Center, n.d.). The negative relationship between masculinity and LMX is also significant at the 99% confidence level. As predicted, employees who exhibit high levels of masculinity experience a lower exchange quality with their supervisors. Lastly, at the 99% confidence level, the strong positive relationship between job satisfaction and leader-member exchange quality is significant. Employees who are in good relationships and work well with their supervisors, go beyond their assigned tasks, have better workdays, which leads to an overall job satisfaction.

Managerial Implications

Since Vietnam is a high power distance culture, Vietnamese employees expect a certain level of power distance between the managers and the employees. Therefore, regarding working with Vietnamese counterparts and subordinates, managers, international managers who are from a low power distance culture, may apply and maintain a high power distance environment to increase the quality of leader-member exchange because Vietnamese subordinates recognize and accept of such power distance. In cultures with low levels of indulgence like Vietnam, where employees are still in high control of their personal leisure due to cultural constraints, supervisors can encourage their subordinates to participate in out-of-work activities as relaxing and reenergizing method. Finally, to increase their subordinates' job satisfaction, managers should focus on enhancing the exchange quality with their subordinates. As subordinates' relationships with the supervisors improve, subordinates will be more satisfied at the work and become workers that are more productive.

Limitations and Future Research

As the sample size was relatively small, future research can use a sample size that is larger or has different demographics. This model did not specify industries of the participants as in different fields, the quality of the leader-member exchange and job satisfaction may have little to no relationship. With respect to power distance and LMX, the study did not emphasize and compare a relationship between a domestic employee and an international manager versus a relationship between a domestic employee and a domestic manager. Moreover, cultural dimensions' scores may vary across different industries. Instead of Hofstede's six cultural dimension scales, new research can utilize the GLOBE Project's nine cultural dimension scale of performance orientation, uncertainty avoidance, humane orientation, instructional collectivism, in-group

collectivism, assertiveness, gender egalitarianism, future orientation, and power distance (Grove, 2005). This new scale will provide a broader view on cultural dimensions with an organizational approach, in hope to provide clearer understanding of cultural characteristics of the sample size.

CONCLUSION

Studying job satisfaction is of high priority to not only human resource managers, but also all managers across the organizational functions. It is important for managers to observe, comprehend, and analyze the new professionally behaviors of their millennial employees to better serve their needs and increase their job satisfaction. The paper studied the relationship between culture, using Hofstede's six cultural dimensions of power distance belief and uncertainty avoidance, and high levels of individualism, masculinity, long-term orientation, and indulgence, and the quality of the LMX, which in turn, influencing employees' job satisfaction. All cultural dimensions, with the exception of masculinity, all positively affect the quality of the exchange between the employees and their supervisors. Moreover, the quality of the exchange between a supervisor and a subordinate has a strong and positive effect on subordinates' job satisfaction.

Appendix A – Measurement Scales

Power Distance Belief Scale

Power Distance Belief					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. People in higher positions should make most decisions without consulting people in lower positions.	1	2	3	4	5
2. People in higher positions should not ask the opinions of people in lower positions too frequently.	1	2	3	4	5
3. People in higher positions should avoid social interaction with people in lower positions.	1	2	3	4	5
4. People in lower positions should not disagree with decisions by people in higher positions.	1	2	3	4	5
5. People in higher positions should not delegate important tasks to people in lower positions.	1	2	3	4	5

Source: Dorfman, P. W., & Howell, J. P. (1988). Dimensions of national culture and effective leadership patterns: Hofstede revisited. *Advances in International Comparative Management*, 3, 127-150.

Collectivism-Individualism Scale

Collectivism					
	Strongly Disagree	Agree	Neutral	Disagree	Strongly Agree
1. Individuals should sacrifice self-interest for the group.	1	2	3	4	5
2. Individuals should stick with the group even through difficulties.	1	2	3	4	5
3. Group welfare is more important than individual rewards.	1	2	3	4	5
4. Group success is more important than individual success.	1	2	3	4	5
5. Individuals should only pursue their goals after considering the welfare of the group.	1	2	3	4	5
6. Group loyalty should be encouraged even if individual goals suffer.	1	2	3	4	5

Source: Yoo, B., N. Donthu and T. Lenartowicz, 2011. Measuring Hofstede’s five dimensions of cultural values at the individual level: Development and validation of CVSCALE. *J. Int. Consumer Market*, 23: 193-210. DOI: 10.1080/08961530.2011.578059

Masculinity Scale

Masculinity					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. It is more important for men to have a professional career than it is for women.	1	2	3	4	5
2. Men usually solve problems with logical analysis; women usually solve problems with intuition.	1	2	3	4	5
3. Solving difficult problems usually requires an active, forcible approach, which is typical of men.	1	2	3	4	5
4. There are some jobs that a man can always do better than a woman.	1	2	3	4	5

Source: Yoo, B., N. Donthu and T. Lenartowicz, 2011. Measuring Hofstede’s five dimensions of cultural values at the individual level: Development and validation of CVSCALE. *J. Int. Consumer Market*, 23: 193-210. DOI: 10.1080/08961530.2011.578059

Uncertainty Avoidance Scale

Uncertainty Avoidance					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. It is important to have instructions spelled out in detail so that I always know what I’m expected to do.	1	2	3	4	5
2. It is important to closely follow instructions and procedures.	1	2	3	4	5
3. Rules and regulations are important because they inform me of what is expected of me.	1	2	3	4	5
4. Standardized work procedures are helpful.	1	2	3	4	5
5. Instructions for operations are important.	1	2	3	4	5

Source: Yoo, B., N. Donthu and T. Lenartowicz, 2011. Measuring Hofstede’s five dimensions of cultural values at the individual level: Development and validation of CVSCALE. *J. Int. Consumer Market*, 23: 193-210. DOI: 10.1080/08961530.2011.578059

Long-Term Orientation Scale

Long-Term Orientation					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I believe in careful management of money (thrift).	1	2	3	4	5
2. I believe in going on resolutely in spite of opposition (persistence).	1	2	3	4	5
3. I believe in personal steadiness and stability.	1	2	3	4	5
4. I believe in long-term planning.	1	2	3	4	5
5. I believe in giving up today's fun for cusses in the future.	1	2	3	4	5
6. I believe working hard to success in the future.	1	2	3	4	5

Source: Yoo, B., N. Donthu and T. Lenartowicz, 2011. Measuring Hofstede's five dimensions of cultural values at the individual level: Development and validation of CVSCALE. *J. Int. Consumer Market.* 23: 193-210. DOI: 10.1080/08961530.2011.578059

Indulgence Scale

Indulgence					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I believe in personal life control.	1	2	3	4	5
2. Freedom of speech is important.	1	2	3	4	5
3. Leisure is highly important.	1	2	3	4	5
4. I remember positive emotions.	1	2	3	4	5
5. More people should be actively involved in sports.	1	2	3	4	5
6. Maintaining order in the nation is not a high priority.	1	2	3	4	5

Adapted from Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, 2(1). <http://dx.doi.org/10.9707/2307-0919.1014>.

Perceived Relationship between Supervisor and Subordinates Scale

LMX 7 Questionnaire					
	1	2	3	4	5

1. You know where you stand with your supervisor and you usually know how satisfied your supervisor is with what you do.	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
2. Your supervisor understand your job problems and needs.	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
3. Your supervisor recognizes your potential.	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
4. I have enough confidence in my supervisor that I would defend and justify his or her decision if he or she were not present to do so.	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
5. Your working relationship with your supervisor is effective.	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree

Source: “Relationship-Based Approach to Leadership: Development of Leader–Member Exchange (LMX) Theory of Leadership Over 25 Years: Applying a Multi-Level, Multi-Domain Perspective,” by G. B. Graen and M. Uhl-Bien, 1995, *Leadership Quarterly*, 6(2), 219–247. Copyright © 1995.

Perceived Job Satisfaction Scale

Perceived Job Satisfaction					
	Very Dissatisfied	Dissatisfied	I can't decide	Satisfied	Very Satisfied
1. The way my boss handles his/her workers.	1	2	3	4	5
2. The competence of my supervisor in making decisions.	1	2	3	4	5
3. The way my job provides for steady employment.	1	2	3	4	5
4. The chance to do something that makes use of my abilities.	1	2	3	4	5
5. My pay and the amount of work I do.	1	2	3	4	5
6. The chance for advancement on this job.	1	2	3	4	5
7. The working conditions.	1	2	3	4	5
8. The way my coworkers get along with each other.	1	2	3	4	5
9. The praise I get for doing a good job.	1	2	3	4	5
10. The feelings of accomplishment I get from my job.	1	2	3	4	5

Source: D. J. Weiss, R.V. Dawis, G.W. England, and L.H. Lofquist, *Manual for the Minnesota Satisfaction Questionnaire* (Minneapolis: University of Minnesota Industrial Relations Center,

1967). Evaluated in J.L. Price and C.W. Mueller, *Handbook of Organizational Measurement* (Marshfield, MA: Pitman, 1986), pp. 228-31

Background Information

1. Gender:

Male Female

2. Age Group:

18-23 24-29 30-35 36-41
 42-47 48-53 54-59 60 and over

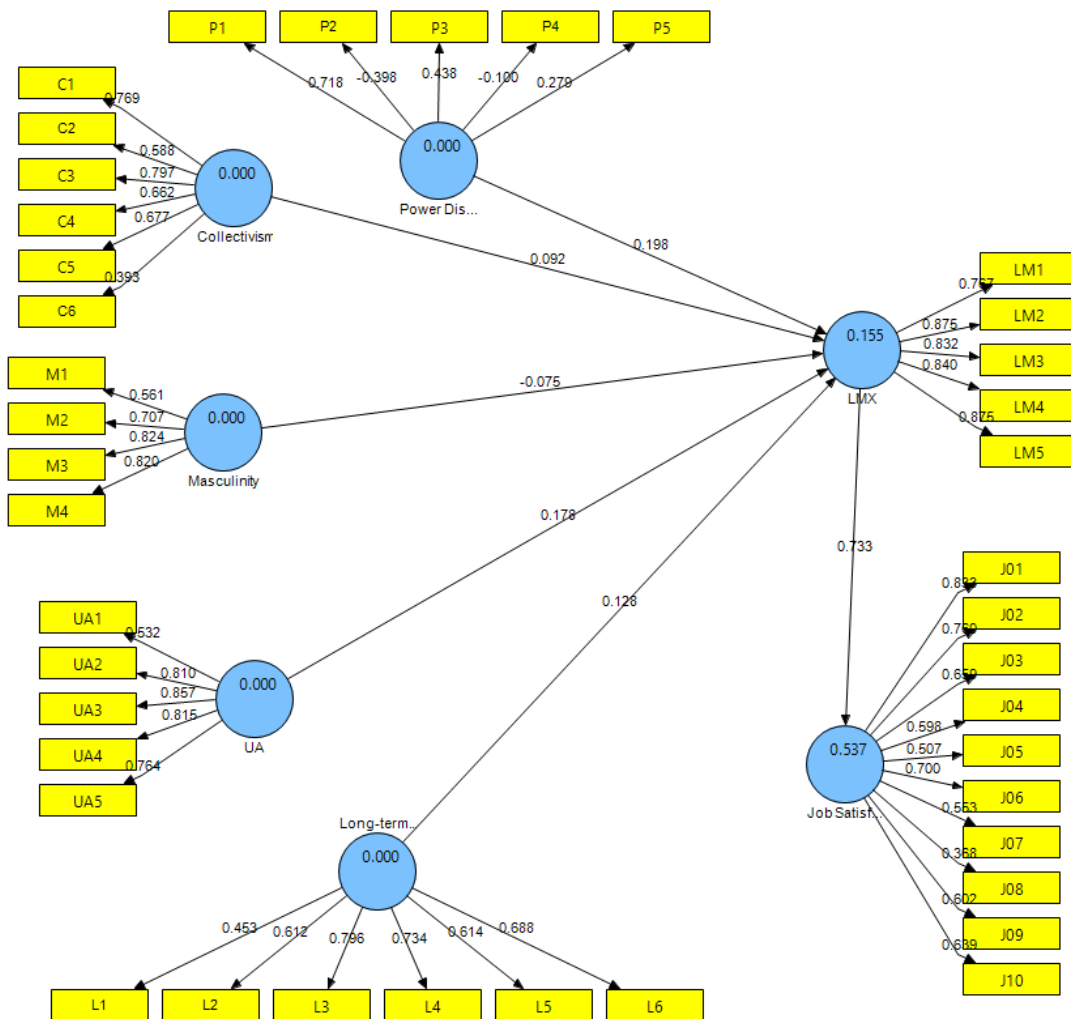
3. Highest Education:

High School Diploma/GED Two-year Degree Bachelor's
 Master's Ph.D.'s Others

4. Working Status

Full-time Part-time

Appendix B – Outer Loadings (Point Estimations and T-values) of the Model



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Using an Enterprise Risk Management Framework to Prepare for Natural Disasters

Thomas Buchanan
Email: thomasbuchanan@go.rmc.edu
Phone: 240-357-4527
Randolph-Macon College
Ashland, VA 23005

*Natural disasters occur only when they affect humans; otherwise, they are simply natural events.*¹

Abstract

The Taylor Anderson Memorial Fund (TAMF) was created and designed to honor Taylor Anderson who was teaching English in Ishinomaki, Miyagi, Japan when she lost her life in the 2011 Tohoku Tsunami. The earthquake and tsunami of 3/11 was responsible for the loss of more than 4,000 people and devastating destruction of homes and commercial structures in Ishinomaki. Through the Randolph-Macon College Shapiro Undergraduate Research Fund, TAMF, and the Tomodachi Initiative, this research project, will make direct comparisons of the U.S. and Japan risk assessment, risk management, and mitigation techniques to reduce the loss to commercial structures and residential housing in affected areas caused by primary natural disasters that affect the east coast of the U.S. and Japan. This research will discuss the effects of the earthquake and tsunami of 3/11 and the potential for more such events, threats to the east coast of the U.S., preventative measures taken by the U.S. and Japan to reduce loss from natural disasters in their own countries, and the many experiences I had while on my journey of research and discovery.

Introduction

The Taylor Anderson Memorial Fund (TAMF) was created and designed to honor Taylor Anderson who was teaching English in Ishinomaki, Miyagi with the Japan Exchange and Teaching Program (JET) when she perished in the 2011 Tohoku Earthquake and Tsunami. Taylor was a graduate from Randolph-Macon College (RMC) and conducted a research study apart of the Randolph-Macon SURF program, where she focused on reporting the works of

¹ Adapted from http://www.tulane.edu/~sanelson/Natural_Disasters/introduction.htm.

Japanese Author Haruki Murakami. After she graduated from RMC she was a JET program Assistant Language Teacher in Ishinomaki from 2008 to 2011.² This fund is sponsored by TOMODACHI through its Fund for Exchanges, and provides an opportunity for students to participate in a research exchange program between RMC and Ishinomaki Senshu University (ISU).³

The TOMODACHI Initiative was born out of support for Japan's recovery from the Great East Japan Earthquake. It invests in the next generation of Japanese and American leaders through educational and cultural exchanges as well as leadership programs.⁴ TOMODACHI is led by the United States Embassy in Tokyo and the U.S.-Japan Council, and is supported by the Government of Japan, corporations, organizations and individuals from the United States and Japan.⁵ The U.S.-Japan Council is a Japanese American-led organization dedicated to strengthening people-to-people connections among Japanese and Americans of all generations.⁶ The TOMODACHI Taylor Anderson Memorial Fund is providing an opportunity for me and 3 of my fellow students at Randolph-Macon College to do research regarding the Tohoku Earthquake of 2011.

This research project makes direct comparisons of the U.S. and Japan risk assessment, risk management, and mitigation techniques to reduce the loss to commercial buildings and residential housing in affected areas regarding primary natural disasters that affect the east coast of the U.S. and Japan. In particular, describe the preventative aspects of construction building codes and practices intended to mitigate the losses to property and human lives. Additionally,

² Adapted from Tomodachi Implementer Agreement

³ Adapted from Tomodachi Implementer Agreement

⁴ Adapted from (<http://usjapantomodachi.org/about-us/>) .

⁵ Adapted from (<http://usjapantomodachi.org/about-us/>) .

⁶ Adapted from (<http://usjapantomodachi.org/about-us/>) .

describe the influence insurance has on preventative and enforcement efforts to protect against natural disasters. And finally, describe the cultural differences between the U.S. and Japan when comparing their reactions to natural disasters with particular attention to the cultural differences in expectations from external support.

This project is aimed at the goal of discovery. The information I learn from conducting this research project will allow me to learn more about construction, engineering, and business, related to preventative measures taken to reduce loss from natural disasters. My expectations for my project are that I learn how to conduct a professional research project as part of my undergraduate experience, to learn more about engineering, construction, and architecture in pursuit of a possible career path and to enjoy the experience I will have interacting with the Japanese people and the different aspects their culture has to offer,

Background

Concerns of the threat of hurricanes to the east coast of the United States have become more prominent over the past decade with hurricanes such as Katrina, Sandy, Rita, and Ike. High winds, heavy rain, and storm surges contribute to the loss of property and lives. For example, hurricane Sandy affected 24 states spanning half-way across the US, claimed the lives of just under 300 people, and caused estimated damages of around \$68 billion (USD).⁷

The threat of hurricanes is not as prevalent in Japan, however, tsunamis have been known throughout Japan's history to be powerful and destructive. Of recent interest is the tsunami that struck the northeast coast of Japan in 2011. The earthquake causing the tsunami has been named the "Great East Japan Earthquake" and is also referred to as the "2011 Tohoku earthquake". The

⁷ Adapted from https://en.wikipedia.org/wiki/Tropical_cyclone

GEJE earthquake is the most powerful in Japan's recorded history and the resulting tsunami damaged or destroyed over one million structures in twenty prefectures (principalities), claimed the lives of nearly 20,000 people, and caused damages estimated at nearly \$37 billion (USD). The Great East Japan Earthquake (GEJE) was the first disaster ever recorded that included an earthquake, a tsunami, a nuclear power plant accident, a power supply failure, and a large-scale disruption of supply chains.⁸ The structural damage the earthquake and tsunami had on buildings was immense. Building damage as of August 8, 2012, included the total collapse of 129,316 buildings, the half collapse of 263,845 buildings and partial damage to 725,760 buildings.

However, the damages could have been worse if Japan had not adhered to the building codes put in place over the past century. The first earthquake resistant construction regulations were introduced in Japan in 1924. In 1891, Japan experienced the Mino-Owari earthquake that had a magnitude of 8.0. After this event research into earthquake resistant structures began. In 1923, the Kanto earthquake led to the introduction of earthquake resistant regulations. These regulations required a minimum thickness for wooden beams, reinforced concrete to have an earthquake load, and braces to be installed.⁹ In 1950, the Building Standards Act was introduced what is known today as kyu-taishin. This change was enacted after the Fukui earthquake of 1948 struck with a 7.1 magnitude. The earthquake resistant design was enforced nationwide and no longer was limited to town areas.¹⁰ Load bearing walls were now required by law and extra framework was required for wooden structures.

⁸ Adapted from GFDRR

⁹ Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

¹⁰ Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

In 1971, there were amendments to the Act for shearing reinforcement and reinforced concrete foundations. This meant that wooden structures had to have reinforced concrete foundations. By 1981, the New Earthquake Resistant Building Standard Amendment was created due to the damage caused by the 1978 Miyagi Earthquake that had a magnitude of 7.4. This amendment is commonly known as the “shin-taishin” building standards. The amendment states that buildings should suffer no more than a slight amount of cracks and should continue to function as normal as a result of earthquakes between the magnitudes of 5 to 7. For rare and large earthquakes with a magnitude of 7 or higher and a Shindo-scale of upper 6 or higher, the building should not collapse.¹¹

In 2000, there were revisions to improve earthquake resistance for wooden structures. These revisions required ground testing for stability to make sure that the building constructed on top of the ground, where it is placed, is suited for the soil. Extra regulations were applied to braces, foundations and the beams of the structure.¹² A 10 year warranty was also applied in 2000 to protect newly built houses against defects. Building certificates and inspections became much stricter by 2006. This amendment was implemented due to the forged earthquake resistance data scandal in 2005. Hidetsugu Aneha, an architect, alleged that a construction company put pressure on him to falsify quake resistance data in order to cut costs.¹³ Mr. Aneha had falsified data for at least 71 out of the 208 structures that he was responsible for designing. Aneha told parliament that he had been falsifying data since 1998. The amendment required that buildings above a certain height were subjected to peer review and apartment buildings over 3

¹¹ Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

¹² Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

¹³ Adapted from <http://news.bbc.co.uk/2/hi/asia-pacific/4527294.stm>

stories had to have inspections in the middle of the construction process.¹⁴ Since 2006, no new building codes have been put into place due to the strict nature of the amendments of the previous years.

Nothing could have prepared Japan for the size and force of the tsunami that struck on 3/11. Strict building codes allowed buildings to stand during the earthquake, but the tsunami brought too much force to protect against. The devastation of 3/11 in Japan was immense leaving question about preventative, relief, and reconstruction efforts.

Risk Management/ ERM

The Enterprise Risk Management Model (ERM) provides a framework of how to manage the different risks that an entity could face throughout its lifetime. The COSO Enterprise Risk Management- Integrated Framework is defined as a process that is affected by an entity's board of directors, management and other personnel designed to identify potential risks that may affect the entity.¹⁵ These risks are then managed within an entity's risk appetite where the framework then provides reasonable assurance regarding the achievement of the entity's objectives.

The ERM is important because every entity, whether it is for profit or not for profit, exists to realize value for its stakeholders. Management decisions are vital to keeping an entity running from day to day. The ERM allows management to deal effectively with potential future events that create uncertainty and respond in a way that reduces possible losses. The ERM Framework is made up of four categories pertaining to objectives. These categories are strategic, operations, reporting and compliance.

¹⁴ Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

¹⁵ Adapted from COSO Risk Management- Integrated Framework

The eight components of the ERM framework are interrelated; the components include internal environment, objective setting, event identification, risk assessment, risk response, control activities, information and communication, and monitoring. The focus of this project is to understand what risk responses should be undertaken. The first step of the process is internal environment where an entity's risk culture is established. In this step, an entity creates a philosophy regarding risk management. Objective setting is applied to form the risk appetite of the entity. Risk appetite is a high level view of how much risk management is needed and how much the board is willing to accept. Firms will not manage risk at an unreasonable level because some events are too costly to prepare for. Risk tolerance is also a key element of objective setting in that it is the acceptable level of variation around objectives.¹⁶

Event identification is the next step of the ERM Framework. It differentiates risks and opportunities, as well as, identifying events, in this case externally, which may have a negative impact on the entity. The last phase in preparation before risk response takes place is risk assessment. This assesses risks from two perspectives; likelihood and impact.¹⁷ Risk assessment can be divided into three steps; identification, measurement, and prioritization. The ERM uses an impact vs. probability table to determine what policy will be put into place based on a combination of high or low impact with high or low probability. Events that are considered to have a high probability and high impact are mitigated and controlled with policies. Events with low impact and low probability are accepted. The ERM's goal is to be able to mitigate losses from natural disasters and allow the business to continue at the level it was at, before the natural disaster struck.

¹⁶ Adapted from COSO Risk Management- Integrated Framework

¹⁷ Adapted from COSO Risk Management- Integrated Framework

Of interest is the owner's tolerance for risk and the expected responses to an event if it occurs. There are four responses possible including avoidance, acceptance, reduction, and sharing.¹⁸ Avoidance, at the extreme, would be a choice by the owner to abandon the project altogether. Proceeding with the project under this response is generally the most expensive mitigation approach. To do so requires expensive techniques and materials that will withstand the stresses presented by the natural event. Acceptance means a recognition of the risks and intention to move forward with the project. This response is most appropriate when the probability of occurrence is low or when other responses are too costly. The most common response is reduction, which seeks to reduce the impact of the risky event by combining avoidance and acceptance tactics at a reasonable level of economic feasibility. Finally, shifting the exposure to one or more third parties comprises the sharing response. In the case of building construction, the risk of losses is shared through insurance coverage.

UN Report

The United Nations World Risk Report of 2013 gives an index of all the countries in the world related to their susceptibility, lack of coping capacities, lack of adaptive capacities, exposure, vulnerability, and a world risk index to natural disasters. Susceptibility is dependent on public infrastructure, nutrition income and the general economic framework. Lack of coping capacities is dependent of governance, medical care and material security. Lack of adaptive capacities is related to future natural events and climate change. Exposure is the exposure of the population to natural hazards such as earthquakes, storms, floods, droughts and sea level rise. Vulnerability is the vulnerability of the society as the sum of susceptibility, lack of coping

¹⁸ Adapted from COSO Risk Management- Integrated Framework

capacities and lack of adaptive capacities. The world risk index is the result of exposure and vulnerability.

The U.S. is considered to be very low in all categories except in exposure where they are placed at a medium risk. The world risk index places the U.S. at a low ranking instead of very low. Japan is considered to be very low or low in susceptibility, lack of coping and lack of adaptive capacities; however, they are in the very high percentage group in the exposure category and world risk index category. Japan is among the highest world risk index percentage countries at 14.10 percent and ranked 15th in the world. The U.S. is ranked 47th among all countries at 3.99 percent risk.

Building Codes/Strategies

The International Building Code (IBC) is a model building code developed by the International Code Council (ICC).¹⁹ This code provides the minimum standards to insure the public safety, health and welfare, insofar, as they are affected by building construction and to secure safety to life and property from all hazards incidents to the occupancy of buildings, structures or premises.²⁰ Each state follows these codes; however, based on the threats to different regions of the U.S., each state has its own set of codes. The Commonwealth of Virginia has its own building code and different standards are followed in different areas of the state. Ashland, Virginia, located two hours west of the coast, follows different standards than commercial and residential structures built along the coastline. Every 2 to 3 years the IBC changes based on different geological patterns and data. The Constitution of the United States of

¹⁹ Adapted from The International Building Code (IBC) Benjamin Trombly

²⁰ Adapted from The International Building Code (IBC) Benjamin Trombly

America grants states jurisdiction over regulation of building construction.²¹ Several different states such as California, Georgia, and Florida have amended the IBC to fit the different threats they identify in their geographic region. These amendments are incorporated into their building codes. The Miami Dade Code is used for the Florida region.

The key strategy to protecting commercial and residential structures from damage caused by hurricanes and gust fronts related to hurricanes, is to maintain the integrity of the building envelope.²² This includes maintaining the integrity of roofs and windows and to design the structure to resist lateral and uplift forces. During a hurricane or high wind event, the forces of wind can affect a home in four ways. These include uplift (wind flows over the roof to create lift effect), racking (horizontal pressure causing house to tilt), sliding (forces house to slide off of the foundation), and overturning (house rotates off of its foundation). A continuous load path is an effective way to mitigate the losses from wind damage. This means roof trusses and gables must be braced, hurricane straps must be used to strengthen the connection from the roof to the walls and the walls to the foundation. Doors and windows must be braced and/or covered. Life safety is a key goal. The ability the “shelter-in-place”, within a deficient structure, can meet this goal.

Flooding is also an element that needs to be identified as a potential hazard linked to hurricanes. Flood mitigation is best achieved by hazard avoidance, meaning risk-informed site selection away from coastal, estuarine, and riverine floodplains.²³ However, some houses are built in flood-prone locations, and floodplains change at different times and can be difficult to predict. Houses built in flood prone locations should be elevated above the expected flood level.

²¹ Adapted from The International Building Code (IBC) Benjamin Trombly

²² Adapted from http://www.wbdg.org/design/resist_hazards.php

²³ Adapted from http://www.wbdg.org/design/resist_hazards.php

Dry flood proofing, wet flood-proofing, and the inclusion of floodwalls on a site can all be used to keep water away from a building and mitigate losses by flooding. Levees require a significant amount of care and are discouraged as a mitigation measure.²⁴

Japan is more prone to earthquake damage and tsunamis that occur as a result. When building structures to mitigate earthquake damage, the main influence is the level of seismic resistance that is desired.

Japan

Under Japan's kyu-taishin building codes (pre-1981), a building was designed to not collapse and protect structures from earthquakes with a seismic intensity scale (Shindo-scale) of upper 5. The Great Kanto Earthquake of 1923 and the GEJE of 2011 produced a seismic intensity of over a 6 in Sendai City. Many kyu-taishin buildings suffered serious damage due to their building code that only prevented damage from earthquakes with a seismic intensity of an upper 5. In 1995, after shin-taishin codes were established, the Hanshin-Awaji Earthquake damaged 0.3% of the shin-taishin structures while 8.4% of kyu-taishin structures suffered serious damage. Nationwide, there are 22,659 kyu-taishin buildings, which is about 20 to 30 percent of all buildings in Japan.²⁵ These buildings, in many cases, can be retrofitted to bring them up to code. To do this, the first floor walls are reinforced; however, the cost of the work is taken on by the owner. The cost is taken out of the building repair fund, but if the funds are not sufficient, the owner has to pay the extra cost. The national government promotes owners to build above to shin-taishin standards by granting subsidies to home and commercial owners.

²⁴ Adapted from http://www.wbdg.org/design/resist_hazards.php

²⁵ Adapted from <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

Taishin is the basic earthquake resistance required by law. There is no dampening system in this code therefore structures take the brute force of the earthquake rather than moving with the earthquake. Seishin is optional, but is recommended in buildings that exceed 3 floors. This code dampers the energy of the earthquake and reduces shaking inside the building. Menshin is the most expensive code to build to. Menshin, like Seishin, is not required by law. Menshin code isolates the building from the ground. An example of this is the newly built San Francisco General Hospital in San Francisco, California. The structure was isolated from the ground by setting the building on ball bearings at its foundation to reduce the force of the shaking. The San Francisco General Hospital can withstand earthquakes up to an 8.2 magnitude. Earthquake resistance of structures in Japan is highly regulated and protected many structures from serious damage in Japan during the GEJE of 2011.

Japan had an advanced disaster risk model (DRM) system that was built up for 2,000 years of coping with different natural hazards and risks. The loss of life and property could have been much greater than what was experienced during the Great East Japan Earthquake (GEJE). There are 5 main elements in the DRM system that has been practiced by Japans communities for years. First, investments in structural measures to hazards, such as, reinforced buildings and seawalls. This also includes cutting-edge risk assessments, early-warning systems, and hazard mapping that is supported by sophisticated technology for data collection, simulation, information and communication.²⁶ Second, a culture of preparedness, where evacuation drills are conducted on a regular basis in communities, schools, and businesses. Third, is stakeholder involvement, where national and local government knows their roles. Fourth, is effective

²⁶Adapted from

<https://openknowledge.worldbank.org/bitstream/handle/10986/17107/793520WP0JP0Ea00PUBLIC00Box0377373B.pdf?sequence=1>

legislation put in place such as building codes that are kept up-to-date. Fifth, is the use of instrumentation to underpin planning and assessment operations.²⁷

In Japan's Tohoku region, 300 kilometers of coastal defense had been built over a 50 year period before the 2011 GEJE. A total of 10 billion dollars was spent by national and local governments to build coastal structures and breakwaters in major ports.²⁸ Although 190 km of the 300km sea wall had collapsed during the tsunami's powerful surge, the wall decreased the force of the tsunami and was able to, in some areas, delay the tsunami's arrival inland. All districts along the Tohoku coast had prepared tsunami hazard maps prior to the GEJE, but the extent of the flooding experienced in some areas greatly exceeded the maximum inundation predicted on the hazard maps.²⁹ Though these hazard maps were predicted well, only 20 percent of the population had ever seen the maps before. The sharing of information among governments, communities and experts was sub-par. Japan had science-based early warning systems in place; however, regular sharing of pre disaster information at the local level is equally important.

Key lessons learned from the 3/11 GEJE and tsunami include: extreme disasters underscore the need for a holistic approach to the DRM, preventative investments pay, but be prepared for the unexpected, DRM is everyone's business, and communication is key. Japan prepared through building resilience by investing in structural and nonstructural measures; nurturing a strong culture of knowledge and learning from past disasters; engaging in wise DRM

²⁷Adapted from

<https://openknowledge.worldbank.org/bitstream/handle/10986/17107/793520WP0JP0Ea00PUBLIC00Box0377373B.pdf?sequence=1>

²⁸Adapted from

<https://openknowledge.worldbank.org/bitstream/handle/10986/17107/793520WP0JP0Ea00PUBLIC00Box0377373B.pdf?sequence=1>

²⁹ Adapted from GDFRR

regulation, legislation, and enforcement. Japan also promoted cooperation among stakeholders, between government agencies and ministries, between the private sector and the government, and with multiple levels of government from local to national to international.³⁰ Japan prepared greatly for disasters, but in the case of a “never event”, it is difficult to balance the probability that the disaster will occur and the cost of implementing codes that are able to withstand a tsunami that impacted Japan’s eastern shore on 3/11.

Culture of Insurance

Many businesses and entities share the risk they encounter. They do this by purchasing insurance plans. Insurance plays a major role in the global economy. Insurance premiums in 2012 made up 6.3% of global GDP, which is a total of 4.6 trillion dollars.³¹ The U.S. rate of premiums is at 8.2%, while advanced Asian economies pay 11.8% of GDP for insurance premiums.³² Japan is the fourth largest non-life insurance market in the world. Japan has increased its purchases of earthquake insurance due to the disasters that have occurred over their nation’s history. Japan practices all four aspects of COSO’s risk management model and sharing is a big part of that. By increasing the amount of insurance premiums that are purchased by home owners and business entities, Japan can pass some of the risk costs to third parties.

Japan purchases more insurance premiums than do residents and business owners of the U.S. This could be because of the higher risk appetite of the Japanese. Japan is located on a tectonic plate that runs through Japan’s largest island of Honshu. It is also located only 130 kilometers away from the tectonic plate that shifted and caused the 2011 GEJE. The east coast of

³⁰ Adapted from GDFRR

³¹ Adapted from <http://insights.som.yale.edu/insights/how-do-you-sell-insurance-across-cultures>

³² Adapted from <http://insights.som.yale.edu/insights/how-do-you-sell-insurance-across-cultures>

the United States does not have the same risk appetite and focuses more on codes that protect against hurricanes. Due to the frequency and severity of the disasters that have occurred in Japan's history, Japan has prepared through risk avoidance, acceptance, reduction and a strong culture of sharing through the purchase of insurance premiums.

Conclusion

The Japanese Disaster Risk Model and Enterprise Risk Management Model both provide effective ways to help reduce damages from natural disasters. Japanese building codes are strict due to the disasters that have occurred in the past and the legislation that has been enacted. Many structures were not damaged by the earthquake of 3/11, but rather by the tsunami that struck as a result. Japan practices what the ERM considers to be reduction. For the past century, the Japanese have built up coastal defenses, enhanced warning systems and hazard maps, and have built structures to stricter codes, to mitigate losses from major natural disasters. Some events like the tsunami of 3/11; however, are too costly to prepare for. The GEJE and tsunami of 3/11 were above the Japanese DRM's risk appetite. They prepared for natural disasters up to the point where it was cost effective to do so. Once the probability of a risk becomes relatively low and is too costly to prepare for, risk acceptance is considered. Some natural disasters cannot be prepared for in a cost effective manner.

For future research, it would be beneficial to study the cost-effectiveness of building for disasters, and delve into the numbers of the cost-benefit analysis of preparing structures for disasters in relation to sharing the risk among insurance companies.

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Sources w/ annotations

http://gfdrr.org/sites/gfdrr/files/publication/GFDRR_Building_Resilience.pdf

- The Global Facility for Disaster Reduction and Recovery gives a detailed explanation of their risk management models in place around the world. Explanations include the effect of disasters on developed and developing countries. GFDRR's Approach: Build resilience now in order to adapt better to the changing climate. Steps include preparation, implementation, monitoring and evaluation and building resilience/ sustainable development.

http://worldriskreport.entwicklung-hilft.de/uploads/media/WorldRiskReport_2013_online_01.pdf

- The World Risk Index explains the susceptibility, coping abilities, and adaptation of all countries to natural disasters. Gives reasons why some countries and people are more vulnerable to natural disasters. Offers solutions to some of the disasters as well. Japan is ranked 15 on the list of most at risk countries while the U.S. is considered to be at a lower ranking.

http://en.wikipedia.org/wiki/List_of_countries_by_natural_disaster_risk#cite_note-2

- List of countries based on their risk to natural disasters by percentage. United States is at 3.99% while Japan is at 14.10%.

<http://www.copenhagenconsensus.com/publication/third-copenhagen-consensus-natural-disasters-assessment-kunreuther-kerjan>

- Paper on Natural Disasters that proposes a series of concrete actions to be undertaken to reduce vulnerability to such large-scale catastrophes. First, build schools that can withstand earthquakes to reduce damage and the number of fatalities to children, teachers and other staff. Second, invest in community flood walls and elevated homes to protect areas subject to floods. Third, strengthen the roofs of houses in countries with high exposure to hurricanes and cyclones to reduce losses from wind damage. Last, set up effective early disaster warning systems to protect civilians from disasters. Relates more to developing countries.

http://siteresources.worldbank.org/INTSF/Resources/Building_Resilient_Communities_Complete.pdf

- "Building Resilient Communities: Risk Management and Response to Natural Disasters through Social Funds and Community-Driven Development Operations" is designed to help Task Teams on World Bank social funds and community-driven development (CDD) operations to identify disaster risk management issues in their programs and projects and to design and implement appropriate responses. Gives detailed models of risk management, new risks, and ways to increase the speed and effectiveness of recovery efforts.

http://www.wbdg.org/design/resist_hazards.php

- Details on provisions and recommendations for building better buildings for all hydro meteorological disasters. Gives advice on different ideas to mitigate losses and codes already in place to prevent loss from disasters.

<http://www.toolbase.org/ToolbaseResources/level3.aspx?BucketID=2&CategoryID=21>

- Provides innovative products and processes, design and construction guides, best practices, performance reports & case studies, and links to other sites in relation to preventing damages from natural disasters.

<http://www.toolbase.org/Home-Building-Topics/Natural-Disasters/hurricane-coastal-construction>

- Link off the previous website many different techniques and ideas as to where to build homes, insurance rates for flooding, building materials and more.

<http://www.dca.state.ga.us/development/planningqualitygrowth/programs/downloads/BestPracticesGuidebook.pdf>

- Best practices for construction codes that protect against natural disasters, but also describes best practices for awareness and education.

<http://www.constructionexec.com/Articles/tabid/3837/entryid/1760/researching-the-building-impact-of-natural-disasters.aspx>

- When protecting structures against earthquakes it is better to build ductile structures that are able to flex to seismic activity. Steel is the best material to use because it is able to flex under the pressure of seismic activity.

<http://www.sciencechannel.com/tv-shows/strip-the-city/videos/the-mystery-of-earthquake-resistant-buildings-at-machu-picchu/>

- Video that we watched together on Machu Picchu's ancient architecture that allowed the city to stand through hundreds of earthquakes.

<http://www.abc.net.au/catalyst/stories/2948245.htm>

- Explains the building of the Tokyo Sky Tree and how it's based on the construction of ancient pagodas that have withstood earthquakes for many centuries.

<http://www.discovery.com/tv-shows/other-shows/videos/smash-lab-earthquake-proof-house/>

- Short video shows a test on an "earthquake proof house" through placing it on what seems to be sliding bearings as a foundation. The house is able to withstand strong earthquake forces, but proves that houses can only withstand the forces of nature up to a certain point and that we can only mitigate losses so much until it becomes too costly.

<http://www.pbs.org/wgbh/nova/ancient/building-wonders.html#hagia-sophia>

- For 800 years the Hagia Sophia has withstood the forces of nature even though it was built on a seismic fault.

<http://www.nbm.org/exhibitions-collections/exhibitions/designing-for-disaster.html>

- Describes the Designing for Disaster exhibit at the National Building Museum. The exhibit examines how we assess risks from natural disasters and how we can create policies, plans, and designs yielding safer, more disaster resilient communities.

<http://www.nbcnews.com/news/world/earthquake-tsunami-anniversary-japan-remembers-four-years-later-n321296>

- A remembrance article of the 2011 Tsunami that claimed the lives of nearly 20,000 people along with a short video that shows the unveiling of the worlds most advanced earthquake simulator.

http://www.concreteconstruction.net/Images/Testing%20for%20Chloride%20Permeability%20of%20Concrete_tcm45-342163.pdf

- For F&R visit source

<http://www.strategicstandards.com/files/InternationalBuildingCode.pdf>

- IBC Benjamin Trombly

<http://www.safestronghome.com/highwind/01.asp>

- Illustration of overturning, uplift, racking, and sliding

http://oceanservice.noaa.gov/websites/retiredsites/sotc_pdf/RTT.PDF

- An older document, but I think it could be used as a comparison as to what building codes and techniques we use today to help prevent structural damage.

<http://www.iii.org/issue-update/catastrophes-insurance-issues>

- Explains hurricanes in good detail. I thought the catastrophe deductible, with the example of Hurricane Andrew could be useful as well.

<http://www.ready.gov/hurricanes>

- Provides steps for before, during, and after a hurricane.

<http://www.ready.gov/tsunamis>

- To be used as a comparison to the previous link.

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=928009

- This paper has a lot of useful information on building codes

<http://www.fema.gov/region-iii-dc-de-md-pa-va-wv#WhatWeDo>

- Used to examine the different regions affected by hurricanes close to us.

<http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-87-3-299>

- *A Statistical Deterministic Approach to Hurricane Risk Assessment*

<http://www.sciencedirect.com/science/article/pii/S0951832008001129>

- Insurance information and hurricane data

<http://www.ready.gov/risk-assessment>

- The diagram at the bottom of the page is a good breakdown of risk-assessment.

http://www.jltgroup.com/content/UK/risk_and_insurance/Risk_Specialist_Articles/Focus_on_Japan_Risk_Specialist_issue_7.pdf

- Looks to be more about life insurance, but gives some insights into the cultural differences.

<http://insights.som.yale.edu/insights/how-do-you-sell-insurance-across-cultures>

- Interesting piece. Asians spend more on insurance premiums as a % of GDP than the US.

<http://www.bloomberg.com/bw/articles/2012-12-06/japans-fear-of-risk-is-getting-dangerous>

- Business Week article. May be of some help.

http://www.toare.co.jp/english/html/pdf/2012_insurance.pdf

- Industry piece on increase in insurance purchases for casualty/property insurance.

<http://www.worldbank.org/en/topic/disasterriskmanagement>

- Link to world bank site with publications on a variety of topics. May be of interest.

<http://www.imf.org/external/pubs/ft/wp/2012/wp12245.pdf>

- IMF working paper on mitigating risks of natural disasters. Some info.

http://www.tulane.edu/~sanelson/Natural_Disasters/introduction.htm

- Nice piece filled with definitions. Some grammar errors.

<http://www.unisdr.org/who-we-are/what-is-drr>

- A UN publication. Interesting twist on definitions. Worth a thorough read.

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- Enterprise Risk Management. This applies to firms with emphasis on internal auditing. I'm thinking we'll take their model and re-define it to fit our use.

<http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>

- Earthquake building codes in Japan. A history of the evolution of building codes in Japan including scandals that took place when new amendments were enacted.

WHAT'S YOUR TYPE? STEREOTYPE THAT IS: AFRICAN AMERICAN STEREOTYPES IN ADVERTISING

WYKELLA PATRICK, COLLEGE OF BUSINESS ADMINISTRATION, SAVANNAH STATE UNIVERSITY, 3219 COLLEGE STREET, SAVANNAH, GA 31404, 478-951-1413, WPATRICK@STUDENT.SAVANNAHSTATE.EDU

ABSTRACT

The research discusses the use of advertisements considered to be 'stereotypical' and the way they are perceived by consumers. The research discusses the stereotypical advertising portraying African Americans. In the research the focus is on the way advertisers use stereotypes to promote their products. Popular companies often use advertisements that are stereotypical to cultures. The paper not only focuses on print ads but also radio ads and television commercials. Moreover, the research examines the success of the product after the release of the advertisement. The research will seek to address the following questions:

- What are the African-American stereotypes held in America?
- What are the differences between the ads featuring Caucasian Americans and African Americans?
- How do African American consumers respond to these stereotypical advertisements?

Keywords: stereotypes, advertising, offensive, branding, consumer perception

INTRODUCTION

Advertising plays a vital role in the lives of everyday consumers. It does not matter where we go or what we do as consumers we will encounter advertising in some way (Krugman, Reid, Dunn, & Barban, 1989). Advertising comes in the form of radio commercials, print advertisements, television campaigns, billboards, etc. Advertising is a field in the broad spectrum of marketing and communication and is the paid form of action or occupation of creating material for promoting the sale of commercial products or services. Advertisements make consumers aware of a product, brand, or service and the goal is to make consumers buy the good or service.

When advertising, businesses have a particular target market in mind that they want to reach. The target market could be segmented by age, income, gender, or even race or culture. When advertisements target a specific race that is when stereotypes often come into play. Advertisers pay close attention to what people think about themselves and others. A stereotype is a widely held fixed image or idea of a certain type of person or thing. Stereotypes about specific races and cultures are very common. Some of the most common stereotypes include: white people not having rhythm, black people loving fried chicken, Asians being geniuses, and Muslims are all terrorist. Stereotyping just like advertising is a psychological process.

Arguably, the most popular and controversial form of stereotype in advertising is that of African Americans. From the beginning of the 20th century to the mid-1960s, advertising using stereotypical images of African-Americans was pervasive throughout the U.S. African Americans were generally portrayed as, unintelligent, ignorant, and unattractive. Although African Americans are not widely portrayed this way currently there are still stereotypes that are being used today. The Black community in the United States does not feel culturally represented in the \$177.8 billion advertising industry (Franklin, 2014). The advertisements either do not feature them or portray

them in a negative light. There are seldom instances where positive stereotyping is used but is washed away in a sea of negative stereotypes.

Stereotypical advertising definitely affects the buying habits of African Americans and their ideas of the brands using the ads. Not only are buying habits affected but also the mind of the consumer is also affected. Stereotypes affect the perception and self-esteem of consumers. The purpose of the research is shed light on the stereotypical advertisements portraying African Americans in the United States. The research explores the differences between the ads featuring Caucasian Americans and African Americans and what this difference says to the African American consumer about themselves. Lastly the research offers a solution to connect African American consumers back to the brands that target them.

LITERATURE REVIEW

African American consumers are one of the most important yet one of the most neglected category of consumers. Visibility and representation are the typical components of research on African Americans in advertising (Siarras, 2008). The recent increase in occurrence derives in large part from black owned publications. Only a small percentage of advertising agencies and advertising executives are black. When it comes to appearance black women are more often seen than black men in ads. Regardless of either gender the portrayal is most often insulting. It has been shown that the depiction of blacks derive from the attitude of whites toward them (Humphrey & Schuman, 1984). This is due to Caucasian American being the largest segment of buyers and what appeals to them will be put in the advertisement. With a negative stereotypical portrayal of African Americans in the media, stereotypes are molded into the minds of other consumers. This not only affects black people in a business consumer sense but also a personal sense. People use media to experience things they have not experienced themselves (Ferle & Wei-Na, 2005). An ad depicting

an African American male as drunk will further increase the public opinion of the African American male. In the recent years of popular culture there has been an increase in ads featuring hip hop music which generally portrays an African American male (Bailey, 2006).

Figure 1



Not only are stereoty
by a popular beer bra

ent in Figure 1 is
in male is

covered up by the picture of the beer and his face is not clearly seen like those of the Caucasian Americans in the ad. The ad is also an example of “tokenism”. Tokenism is minimizing the screen presence of a minority in a crowd (Arora & Wu, 2012). The feeling of superiority is perceived by consumers especially of African American descent. It has been proved that blacks and other minorities are often associated with predefined products like food, beverages, personal care items, and clothes and not of those ads which promote high-value products (Ferle & Weina, 2005). Minorities but more specifically African Americans more often than not get the short end of the stick. In order to cut down the stereotype it is not secret that African Americans should be portrayed as the successful people they have come to be in society. There are ads that portray African Americans in a positive light but they are generally limited to being athletes.

Figure 2



Figure 2 is an example of a stereotypical ad by Intel in 2007 where the African Americans are athletes/employees, the Caucasian American is the boss and there is a strong slavery feeling within the ad. This advertisement caused much controversy for Intel. The ad portrays white superiority over those who are black. After much criticism the ad was taken down. The ad could have easily been non offensive with a few changes including not having all of the runners be of African American descent. Precise and positive representation of minorities in advertising is significant and directly related to the presence of minorities in society (Siarras, 2008). The second ad in Figure 2 is that of one by Nivea. Nivea's ad says to "Re-civilize Yourself" with a clean cut African American male with the head of another African American male in his hand getting ready to throw the head. The head of the man being held has an afro and a seemingly angry face. Nivea's ad offends African Americans in a different way than the previous ads. The ad portrays blacks as uncivilized. The brand put out an ad featuring a Caucasian American also holding a head but there is no lines of copy referring to being civilized. The differences in the ads are jarring and offensive.

Not all brands are insulting to the African American community. Some brands positively highlight African Americans in a respectable way. Mercedes Benz is a prime example. Mercedes

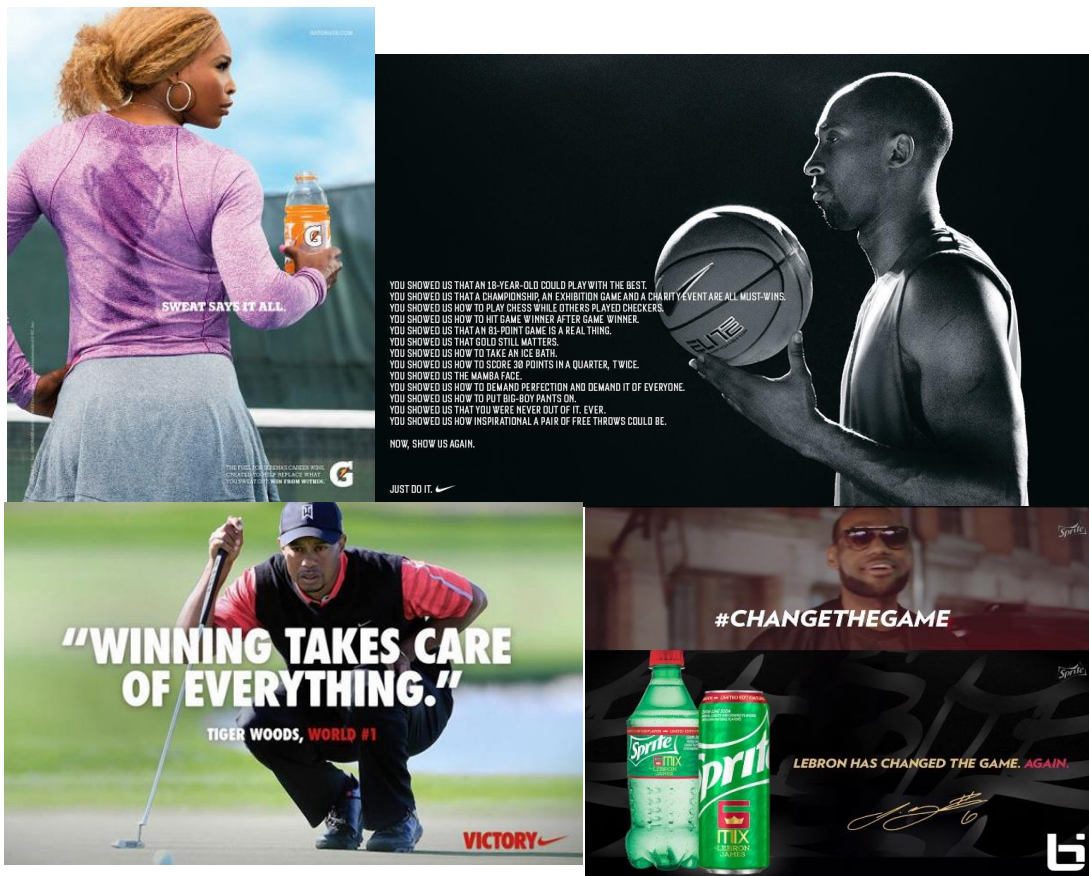
Figure 3



Benz ;
come :

This positive portrayal takes a stand on typical ads which describe African Americans as being of lower achieving status (Punyanunt-Carter, 2008). Very few advertisements will feature African Americans that are not a celebrity of some sort. There are a plethora of print advertisements and television campaigns featuring African American athletes and celebrities. Figure 4 featuring Serena Williams for Gatorade and Kobe Bryant for Nike gives an idea of this fact. This is not an accurate representation of the population and the young viewers of the ads like children will be shown an unrealistic achievement for average African American (Taylor, 1995).

Figure 4



In addition to print ads, stereotypical ads are also exhibited through television campaigns. It is not only the unpopular ads that perpetuate stereotypes and racism. There are several popular advertisements that feed into stereotypes. Figure 5 shows two screenshots of television campaigns. The screenshot on the left is from a Doritos commercial and the right is for Burger King. The Doritos begins as an African American opens the door to see her date. She tells her date to have a seat and introduces her son to him. As the woman is walking away in a short skirt the man ogles her and has a seat. The man talks to the little boy and grabs one of his Doritos. The little boy instantly slaps the man and tells him not only can he not touch his Doritos but not to touch his mother also. Although the commercial was humorous it still perpetuated stereotypes. The

Figure 5



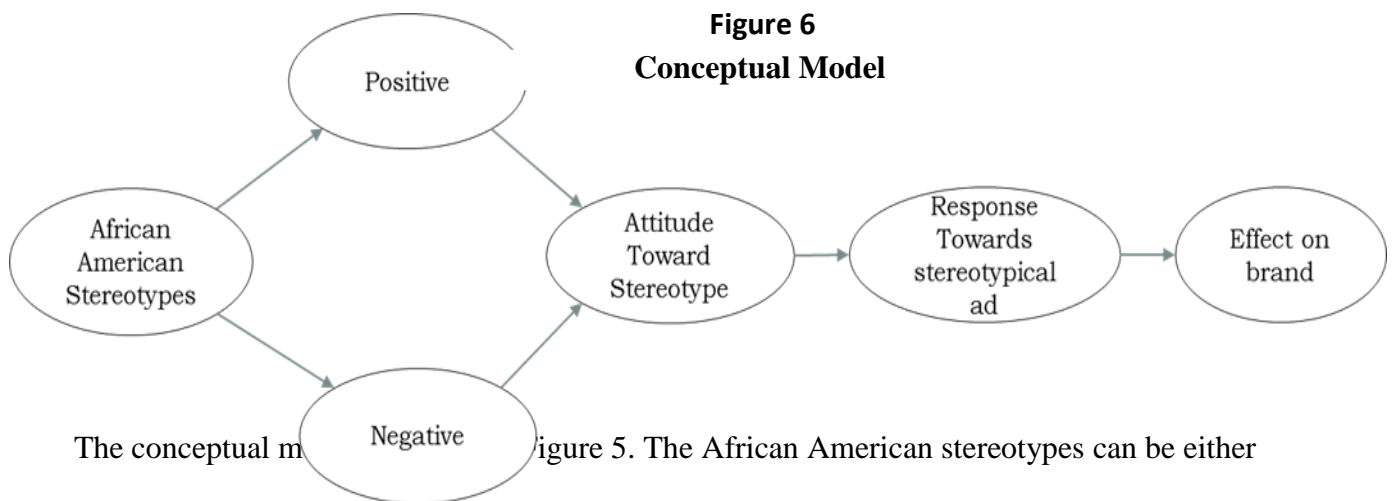
commercial exhibited the stereotype of the black single mother, an unruly black little boy, and a disrespectful little boy. Black people in advertising are rarely portrayed in traditional family settings. (Bang, 2003). The screenshot on the right is the crispy chicken wrap from Burger King. In the commercial a customer goes up to the counter to order and he asks the cashier what is in the crispy chicken wrap. Out of nowhere Mary J. Blige appears on the table and says with much sass and attitude, “What’s in the new crispy chicken wrap”. She then proceeds to sing on top of the table. This commercial struck viewers negatively because a black woman singing about the goodness of fried chicken is not something African American viewers want to see. The ad was immediately pulled from Burger King’s YouTube page.

The stereotypes are not always shown visually. Stereotypes can be perpetuated through audio also. What individuals hear may impact what they purchase. (AARTI S. IVANIC, 2015) In the city of Savannah this is done quite often. According to the 2010 Census, the racial demographics of the city are that of majority African American. Almost 60% of the city is African American/black. The advertisements often reflect the target market of African Americans through stereotypical ads. 411 Pain is a legal medical and medical service promoted in Savannah.

The company produced a radio commercial to the tune of a popular sexually graphic hip hop song released in 2002. The words were changed to better fit the service but the commercial caused an uproar in the community. This ad fed the stereotype that the only way to communicate to a black audience is through rap music and many people were offended. Presidential candidate, Ben Carson, fueled the same stereotype with his newly released radio advertisement. His purpose was to reach the young African American people to go out and vote but it could have a negative effect and produce much backlash.

This paper will seek to find out if the stereotypical advertisements have an effect on consumer's attitudes and in turn if the brand is affected.

**Figure 6
Conceptual Model**



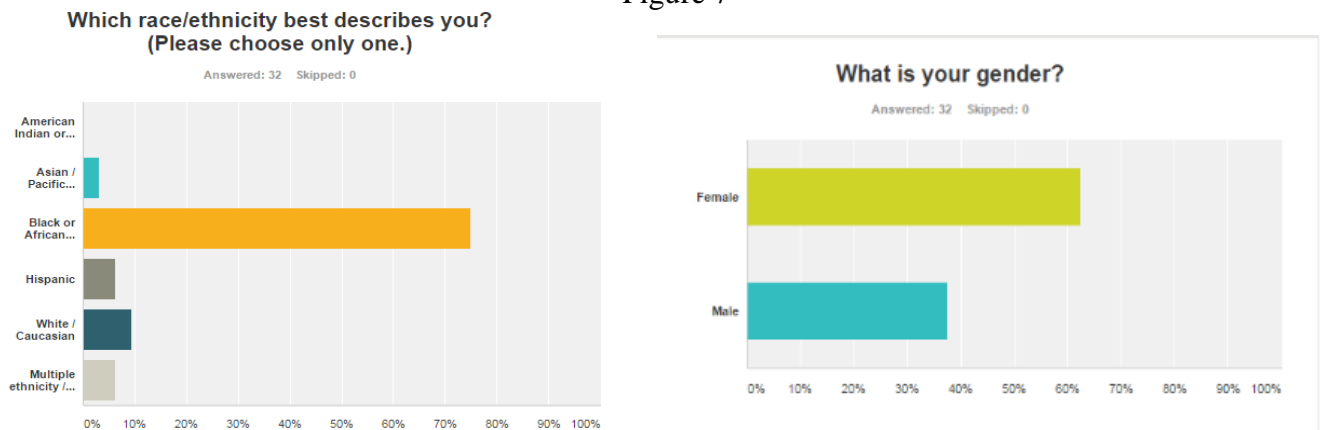
The conceptual model in Figure 5. The African American stereotypes can be either positive or negative. The stereotype be it positive or negative produces an attitude toward the stereotype from the consumer. This attitude toward the stereotype determines the response toward the advertisement which will determine the effect if any, it has on the brand.

RESEARCH METHODOLOGY/CASE STUDY

A study was conducted with a sample of 32 through simple random sampling in the Georgia area. Figure 6 shows of the 32 people, 75% of the sample were of African American race, 9.38% Caucasian/white, 6.25% multiple ethnicity, 6.25 Hispanic, and 3.13% Asian. 62.5% of the

sample were females and 37.5 were male. 78% of the sample were between the ages of 18-24. The survey asked questions including but not limited to, are you aware of any stereotypes regarding your ethnicity or any other ethnicity, have you ever seen a commercial or print ad that exemplified a stereotype, do you believe African American stereotypes are prevalent in the media, and would you continue to use a brand if the company put out an advertisement or commercial that you felt was stereotypical.

Figure 7



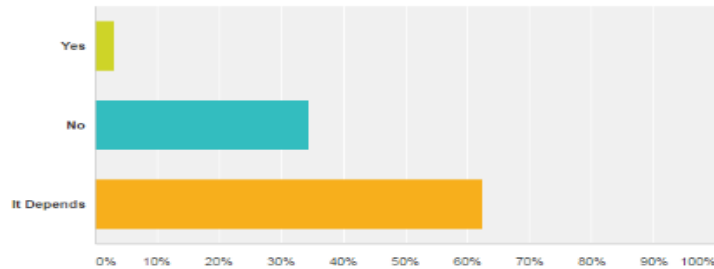
RESULTS/ IMPLICATIONS

The results of the survey concluded that 70% of the sample have actually viewed a print advertisement or commercial that exemplified a stereotype. Some of the brands that the sample listed for demonstrated stereotypes in their advertising were MTV, McDonald's Dawn, Nike, Apple, Popeye's, Carl's Jr, and Go Daddy. Almost 90% of the sample felt that African American stereotypes more than any other is prevalent in the media. Of that percentage almost half of the sample felt that African Americans are portrayed negatively in those ads. The other half felt that the portrayal is slightly positive. An overwhelming 70% of the sample felt that their specific race is not accurately portrayed in the advertisements.

Figure 8

Would you continue to use a brand if the company put out an advertisement or commercial that you felt was stereotypical?

Answered: 32 Skipped: 0



Even though this is true Figure 8 shows only roughly 60 % of the sample said it is possible that they would switch brands if a brand they were using exemplified a stereotype in their ads. 34% said that would not change brands because of stereotypical advertisements. According to the data the effect on brand is generally nonexistent by stereotypical advertisements. Although the sample feels strongly towards stereotypical advertising and take notice of it often, it is not directly correlated to purchase intentions and effect on the brand.

CONCLUSION

The purpose of the research sought to answer what are the African-American stereotypes held in America, what are the differences between the ads featuring Caucasian Americans and African Americans, and how do African American consumers respond to these stereotypical advertisements. According to the research the African American stereotypes are vast and date back to over a hundred years ago. They include animalistic nature, unintelligence, and inferiority to other races like Caucasians. According to the data, the African American community has a strong response and feeling toward the advertising but it does not definitively affect whether or not they will stop using the brand. Most races feel that they are not represented fully in the media and this

affects more than the business world. The effects can prove to be psychological. Although the survey showed a significant amount of opinionated data there were limitations throughout. The sample consisted of multiple races which represented the population of the Georgia area well. The research would have been more thorough if the sample were shown specific ads that were deemed to be stereotypical to some extent. In addition a larger sample should be use to get a more accurate picture of how stereotypes affect a brand. Although the data does not suggest that stereotypical advertisements result in a loss of sales or an increase in brand switching, it is important for consumers to feel culturally represented in the media. It can be hypothesized that if brands make the effort to survey the populations and represent targeted cultures more accurately, then there would be less issues with stereotypical advertising.

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A META-MODEL OF ACADEMIC DISHONESTY

Patsy G. Lewellyn
University of South Carolina Aiken
Aiken, SC 29801

ABSTRACT

This paper proposes a theoretical model to support more rigorous future research on cheating in higher education. Utilizing and combining the Fraud Triangle and the Audit Risk Model, the proposed “Meta-Model of Academic Dishonesty” is grounded in the existing literature on academic dishonesty.

INTRODUCTION

The public has often ascribed responsibility for the monumental business failures of the recent past to a failure to develop moral sensitivity as part of business education. A recent Wall Street Journal article chastised academe, saying “By failing to teach the principles of corporate governance, our business schools have failed our students” [29]. This attitude signals that initiatives to instill business ethics and foster moral development in business curricula are falling short of the expectations held by the general public.

Research tells us that students who cheat in college are more likely to engage in unethical behaviors in their work life [44] [35] [51]. These findings suggest an increasingly dismal future in business, and a call to action for academicians who value the moral development of undergraduates. This challenge is especially relevant to accounting faculty whose students are future members of a profession for whom the public holds high expectations of integrity, and whose charge is to help protect the interests of absent owners [48].

First appearing in accounting literature in a 2010 review, research on academic dishonesty (cheating) has come into its own as a stand-alone topic, highlighting the pervasiveness of the problem in present day higher education [4]. The phenomenon of academic dishonesty, including all forms of cheating, has grown exponentially over the past several decades. One recent study reports that rates of cheating among U.S. accounting students had increased to 64% in 1993, from 39 % increase in the early 1960s [39]. Another study found almost half (45%) of students believe that cheating is socially acceptable [11].

Recent studies have examined myriad factors related to cheating including: definitions and categories of cheating [8] [41]; antecedents of cheating [26]; rationalizations for cheating [37]; and intentions to cheat in future [11]. Unfortunately the body of work suffers a lack of theoretical basis for rigorous study or generalizability of findings [4]. Perhaps the theoretical framework that would support this research lies right beneath the accounting professor’s very nose...elsewhere in the accounting literature.

Opportunely, the subject of fraud has been extensively studied, resulting in theory evolving over six-and-a-half decades.. Fraud theory offers promise for informing a paradigm of cheating in educational settings. Additionally, the study of academic dishonesty may be further enhanced

through the use of risk analysis and a well-worn audit-planning tool, the “Audit Risk Model”, used by auditors to manage their reputational and monetary risk associated with individual audit engagements.

The current global financial crisis, numerous failed financial institutions, and epidemic corporate fraud in recent years have enriched an already rigorous body of literature on assessing, detecting, and preventing fraud. If indeed cheaters become fraudsters, perhaps the models in use to study fraud can be useful in the study of attributions and prevention of academic dishonesty. The purpose of this paper is to make the case that existing literature on academic dishonesty is highly compatible with two well-established frameworks -- the Fraud Triangle and the Audit Risk Model.

The remainder of the paper is organized as follows. A review of the development of fraud theory in the study of fraud and an explanation of the Audit Risk Model in mitigating risk to practitioners follows. Relevance of these to the study of academic dishonesty is then discussed. The proposal of a meta-model as a theoretical framework for research on academic dishonesty is then described through the mapping of existing empirical results to the model. Conclusions and suggestions for future research end the paper.

FRAUD THEORY AND THE AUDIT RISK MODEL

Fraud Theory

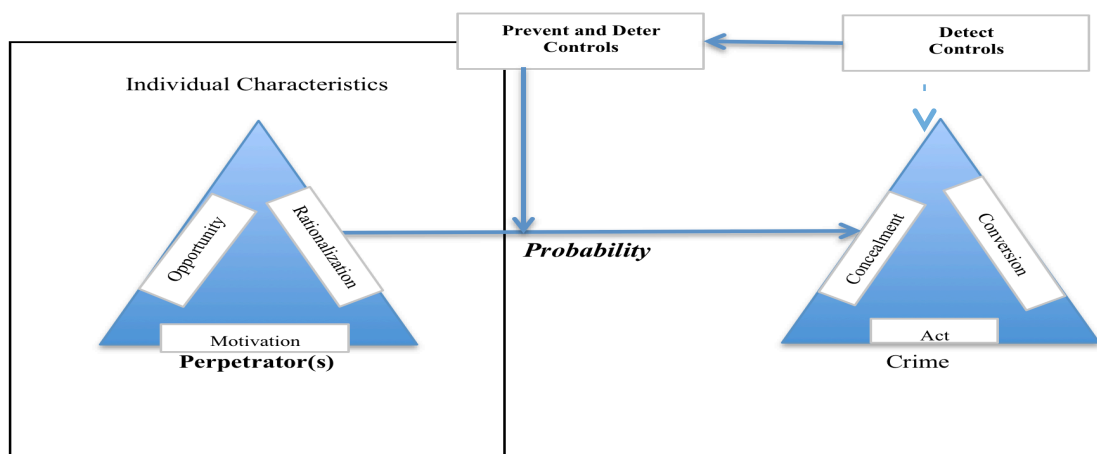
Fraud theory, beginning with the “Fraud Triangle” in the early 1950s [16] [17] has continued over the past six decades. These seminal works, first published in psychology literature, hypothesized three *necessary conditions* for a fraudulent act to occur: (1) opportunity – the perception of probability that the act will be undetected; (2) rationalization – justification used to reduce cognitive dissonance within the individual, and (3) perceived pressure – a personal problem that creates the motive. As financial markets and fraud schemes grew in complexity, a corollary model was developed to include the *elements of the fraudulent act* itself, the “Triangle of Fraud Action” or “Elements of Fraud” [2] [34]: (1) the act - the method/nature of the fraudulent act; (2) concealment – the method of hiding the act; and (3) conversion – the process of making the fraud useable by the actor.

More recently an expanded framework for the study of fraud was enhanced by the addition of behavioral and psychological theories that seek to identify personality and behavioral characteristics as antecedents of fraud [18] The revised model, the “Meta-Model of White-Collar Crime” (Figure 1) builds out the original Fraud Triangle in several important ways:

1. The vector between perpetrator and crime represents the Probability, upon which individual characteristics and countermeasures (controls) mediate or moderate
2. Repetitive fraudulent acts desensitize “rationalization” and can create a criminal mindset over time [17]
3. If a criminal (aberrant) mindset is present, the “rationalization” and “need” components of the Triangle are replaced by “arrogance” and “aberrant thinking” [9]

4. Inclusion of a fraud scale that treats the degree of fraud risk as *jointly* determined by opportunity, rationalization, and motivation. The scale operationalizes interdependence of the three characteristics (e.g. if motivation, perceived opportunity and rationalization are high, the risk of fraud is higher than if any one of the three are low) [2]
5. Expands “perceived pressure”, renamed “motivation” to include a variety of motivations for fraud (money, ideology, coercion, ego/entitlement) beyond personal financial need [34]
6. The personal capacity for exploitation is added as a modifier to “opportunity” (without the personal capability to discern opportunity and conceal the act, the fraud would not be possible) [56]
7. The probability of fraud is modified by three A-B-Cs of crime (whether the fraud resulted from a: *Bad Apple, Bad Bushel, or Bad Crop*) [45]. The probability of fraud is increasingly higher from an individual (Apple), to a Bushel (a group, collusion), or to a Crop (cultural/social environments that influence fraud – pervasive deficiency of integrity of management/organization/culture/society)
8. Anti-fraud measures are added to the framework in the form of deterrents instituted to detect and/or punish fraud, mitigating both the Probability (that fraud will occur) and the elements in Fraud Triangle of Action (effective prevent and deter controls will reduce the ability to convert an act for personal gain, or can reduce the likelihood of a successful concealment, or can modify the types of acts possible in the situation; effective detection controls will reduce probability through fear of getting caught)

Figure 1
Meta-Model of White-Collar Crime



(Dorminey, 2012)

Audit Risk Model:

The audit risk model in SAS No. 47 is used to quantify and manage the risk associated with an audit engagement. If the audit results in an opinion that is not congruent with the true state of the financial statements, the auditor faces risks beyond financial loss, including reputational damage, loss of public confidence, and loss of value placed upon the services offered. Thus, auditors use a tool to attempt to minimize their overall risk. The Audit Risk Model uses the multiplicative form of three distinct types of risk every audit has that determine overall audit risk:

$$AuditRisk = InherentRisk \times ControlRisk \times DetectionRisk$$

where:

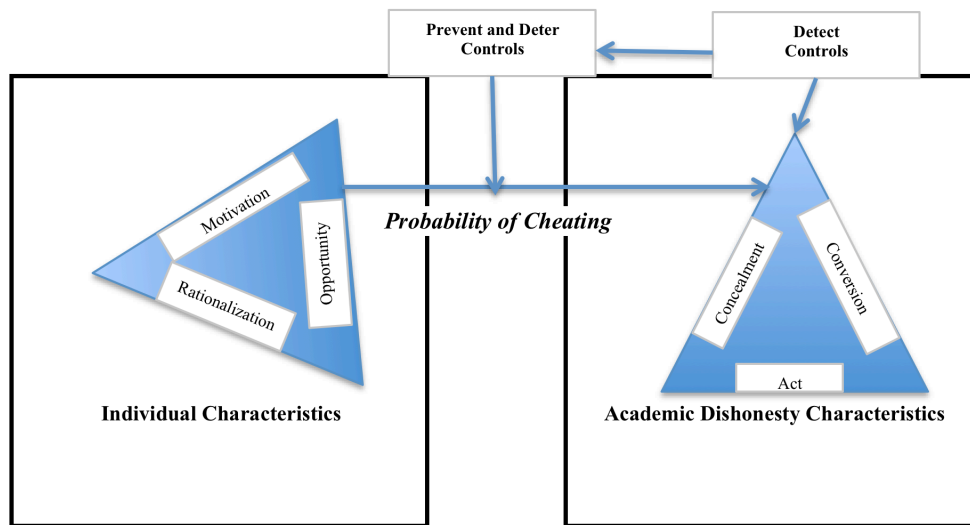
- AR represents the risk that the auditor will express an opinion on financial statements that is incongruent with their true state (e.g. that an unqualified opinion will be issued on statements that in fact contain material misstatement)
- IR represents susceptibility of financial statements to misstatements that is out of either client or auditor control
- CR is the risk that control measures intended to prevent, detect, and/or correct misstatements will fail to do so, resulting in the existence of material misstatements in the financial statements
- DR is the risk that the audit procedures and evidence used to support the audit opinion rendered fails to detect a material misstatement

Applicability of “borrowed” models:

This section provides an argument for the applicability of the Fraud Triangle/White-Collar Crime Model and the Audit Risk Model to the study of academic dishonesty. Finally the application of these two tools results in the description of a theoretical framework for future research in Academic Dishonesty.

Because the Fraud Triangle initially appeared in psychology literature and makes no distinction among relevant subjects, it seems reasonable to assume, since students are human beings, that the model for fraud would be appropriate in other areas of aberrant behavior, such as cheating. The Fraud Triangle, representing the necessary conditions for fraud to occur in the workplace, provides a reasonable framework to describe the necessary conditions for college cheating to occur. Step one in developing the new model renames the Fraud Triangle the “Cheating” Triangle. According to literature on dishonesty in general, most people have incentives to cheat [5], and most students arrive on the college campus already inured (socialized) to the acceptability of cheating in high school [30]. Studies that have examined the personal characteristics of “Motivation” and “Rationalization” in the literature on academic dishonesty indicate there is a great deal of overlap with findings in the Fraud literature. Table 1 illustrates the applicability of the constructs in the Cheating Triangle in the section that follows.

Figure 2 Step 1: Cheating Triangle



If the future of ethical business is dependent upon moral development in undergraduate students, it is incumbent upon faculty to actively involve themselves in reversing the upward trend in academic dishonesty in undergraduate education. If faculty wish to play a part in reversing the trend in college cheating, it would be useful to have a tool to minimize their risk in assessment as it relates to academic dishonesty and the awarding of grades. It is proposed here that the Audit Risk Model is a tool that can be reimagined for this purpose.

In Step 2 the Audit Risk Model is repurposed in the context of the risk of unintentional rewarding of cheaters (and consequential punishing of non-cheating students) by awarding grades not substantiated by actual learning. The repurposed model, entitled “Assessment Risk,” is illustrated in Figure 3, followed by a definition of each type of risk involved in assessment resulting in an inappropriate grade.

Figure 3
Step 2: Assessment Risk Model

$$\text{AssessmentRisk} = \text{IndividualRisk} \times \text{CountermeasureRisk} \times \text{DiscoveryRisk}$$

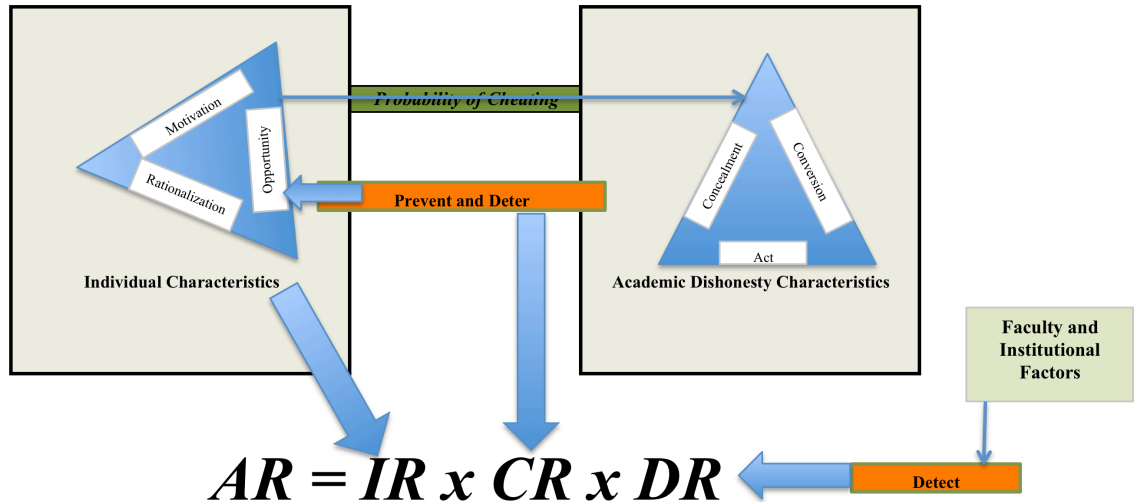
where:

- AR represents the risk of awarding a grade not earned
- IR is the risk that the student possesses motivation and rationalization necessary to cheat – the *propensity* to cheat (factor of both reason and ability to rationalize behavior)
- CR is the risk that countermeasures (anti-cheating policies and procedures) implemented to prevent/deter/detect cheating will fail to do so, correlating with the Opportunity component in the Cheating Model

- DR represents the risk that an instructor will fail to detect and/or act on cheating behaviors in a disciplinary manner; it is a function of attitude, capability, and awareness of the instructors, as well as certain institutional and cultural factors

The proposed model of academic dishonesty shown in Figure 4 combines the Cheating and Assessment Risk models described in steps 1 and 2.

Figure 4
Meta-Model of Academic Dishonesty



The model of Academic Dishonesty considers individual characteristics of students that would be antecedents of cheating acts; the elements of cheating (nature of act, ability to conceal, and ability to gain); and the risks of inappropriate assessment/reward by the instructor related to cheating – Assessment Risk (AR), which is a function of: Individual Risk (IR) – characteristics inherent in human nature and those related to personal circumstances and the individual perception regarding opportunity to cheat; Countermeasure Risk (CR) – the risk that initiatives designed to prevent, deter, and/or detect academic dishonesty will fail; and Discovery Risk (DR) – that the instructor will fail to detect and/or act on cheating when it occurs. Assumptions of the model include:

- AR of less than 100% is desirable in order to reverse the recent trend in cheating in higher education
- IR is determined by individual circumstances, culture, previous experience, and psychological factors that are not quantifiable by objective means, thus should be assumed to be 100%
- $CR \times DR$ must be $< 100\%$ to lower AR to an acceptable level
- CR is inversely related to effectiveness of Prevent and Deter countermeasures
- DR is inversely related to effectiveness of Detect countermeasures

“Opportunity” – the perception by the individual that a weakness in the system offers an opportunity to cheat – belongs to the Individual Characteristics part of the model, but could be subject to modification by forces outside the individual. Opportunity could be modified, for example, by the perceived effectiveness of the anti-cheating measures that have been implemented to prevent and/or detect acts of cheating. If the student perceives that effective anti-cheating measures are in place, and he/she fears the repercussions of getting caught, the “Opportunity” variable will be affected.

DOES THE MODEL FIT?

Extant literature on Academic Dishonesty has focused in large part on antecedents to cheating, what constitutes cheating, and various institutional and demographic factors. The literature can be related to the Academic Dishonesty Model from several perspectives. In one view, the findings can be related to the various components of individual characteristics or characteristics of cheating behaviors. A previous study mapping this literature found that each component of both triangles has been described in a recent study [36]. Table 1 summarizes the significant studies/variables from that review.

Table 1
Individual and Behavioral Characteristics
Related to Academic Dishonesty

Characteristic	Factor Examined	Citation
Individual: Motivation	Fear of failure/pressure to succeed	(Ameen, 1996) (Duff, 1998) (Abdolmohammadi, 2007)
	Financial need	(Bennett, 2005)
	Financial support (family, loans, scholarship)	(Introna, 2003) (McCabe D. L., 2001)
	Time constraints	(Park, 2003) (Franklin-Stokes, 1995)
Individual: Rationalization	Perception of unfairness	(Macgregor, 2012)
	Peer behavior	(McCabe D. L., 1997)
	Lack of moral development	(Trevino, 1986) (Abdolmohammadi, 2007)
	Alienation	(Ashworth, 1997)
Individual: Opportunity	Technology	(Bernardi, 2012) (McCabe D. L., 2001)
	Countermeasures	(Smith, 2002) (Bernardi, 2012)
Cheating: Concealment	Countermeasures	(Bernardi, 2012)
	Likelihood of getting caught	(Ameen, 1996)
Cheating: Conversion	Perception of success	
Cheating: Act	Types of cheating behaviors	(Burrus, 2007) (Grasgreen, 2012)

Countermeasures	Institutional Culture	(O'Neill, 2012) (McCabe D. L., 1997) (Verschoor, 2004)
	Intervention types	(Bernardi, 2012)
	Relational	(Macgregor, 2012)

Much of the literature on Academic Dishonesty has examined the effectiveness of various countermeasures to cheating – those procedures initiated in order to decrease the opportunity to be successful in various modes of academic dishonesty. Table 2 reports the direction of relationships reported in recent literature on Academic Dishonesty, mapped over the risk factors in the Assessment Risk Model.

Table 2
Relationships with Risk Components

	DIRECT	INVERSE
Individual Risk (Motivation; Rationalization)	<ul style="list-style-type: none"> • Fear of failure (Abdolmohammadi, 2007) (Ameen, 1996) (Duff, 1998) (Grasgreen, 2012) • Financial need (Bennett, 2005) • Financial support (Introna, 2003) • Time constraints (Errey, 2002) (Franklin-Stokes, 1995) (Park, 2003) (Macgregor, 2012) • Perceived unfairness (Macgregor, 2012) • Lifestyle (Burrus, 2997) • Major (Yu, 2006) (Klein, 2007) • Peer behaviors (Macgregor, 2012) (Burrus, 2997) (Carrell, 2008) 	<ul style="list-style-type: none"> • Institutional support (Guo, 2011) • Fear of repercussions (Grasgreen, 2012) (Ameen, 1996) • Understanding of cheating (Guo, 2011) (Burrus, 2997) • Perceived seriousness of cheating (Baack, 2000) • Level of moral development (Trevino, 1986) (Abdolmohammadi, 2007) (Imran, 2013) • Positive relationship with faculty (Macgregor, 2012) • Religious/ethics training (Shaub, 1994) (Earley, 2004) (Bloodgood, 2008)
Countermeasure Risk	<ul style="list-style-type: none"> • Technology 	<ul style="list-style-type: none"> • Countermeasures (Smith, 2002) (Bernardi, 2012) • Culture of integrity (O'Neill, 2012) (McCabe D. L., 2001) (Verschoor, 2004) (Jordan, 2001) • Early interventions (Bernardi, 2012) (Grasgreen, 2012)
Discovery Risk	<ul style="list-style-type: none"> • Lack of time (Keith-Spiegel, 1998) • Lack of institutional support (Keith-Spiegel, 1998) 	<ul style="list-style-type: none"> • Countermeasures (Bernardi, 2012) (Smith, 2002) • Institutional culture (O'Neill, 2012) (McCabe D. L., 2001) (Verschoor, 2004) (Jordan, 2001)

From Literature to Theoretical Model: summary of relationships

Individual Risk (IR) is a function of both incentive and attitude (the ability to rationalize the behavior). Taken together, the student's propensity towards cheating has been found to be directly related to fear of failure (to maintain an acceptable GPA; of expulsion; of being accepted into graduate school), financial need, especially as it relates to self-supporting students who have to work and/or support family, the financial support of others (family, scholarship, loans), time constraints enable justification of cheating (related to holding a job, family responsibilities, extracurricular activities), perceptions of unfairness of instructor or assignment load (unrealistic expectations, deadlines), lifestyle choices (use of alcohol, Greek membership, athletics), choice of major (business majors are more tolerant of cheating than nonbusiness majors; accounting and finance majors perceive ethics as less important than nonbusiness majors per Klein et al), and the cheating behaviors of peers (students reported the cheating of friends aided the ability to rationalize their own cheating). Conversely, the Incentive Risk has been found to be inversely related to institutional support for academic integrity, fear of repercussions if caught (expulsion, exposure, lack of faculty recommendations), an understanding of exactly what constitutes cheating (awareness of the various types of cheating) is related to the capacity to rationalize), the perception that cheating is a serious and devious moral choice, the level of moral development, sound and friendly relationships with faculty based upon the perception of mutual caring, and degree of religious/ethical training.

Countermeasure risk (CR) is directly related to the increased use of technology (using cell phones to obtain unauthorized assistance from the internet or another person; use of electronic devices to store unauthorized information; vast access to the work of others available to plagiarize; ability to have another person complete assignments). Cheating has been found to be more prevalent on larger campuses [39]. The CR is inversely related to a strong institutional culture of integrity, including ethical codes, strong commitment to adherence at the highest levels of administration, and education for faculty and staff. Jordan found knowledge of institutional policies on cheating impacted students' attitudes toward cheating. Also early interventions (those taking place prior to arriving on a college campus) have been found to reduce the risk of cheating [31].

Discovery risk (DR) has shown direct relationship to lack of time and lack of administrative support. Discovery risk is inversely related to the presence of effective countermeasures of detection, and a strong institutional culture of integrity.

CONCLUSIONS AND RECOMMENDATIONS

Results of a review of the literature on Academic Dishonesty resulted in findings that support adopting a slightly revised version of the most recent theoretical model for the study of fraud. Additionally, the Audit Risk Model proved to provide a useful framework for assessing and managing the risk to faculty of inadvertently rewarding dishonest students, and concurrently punishing honest students, using a categorization of risks associated with academic dishonesty,

their sources, their controllability, and the hypothesized antecedents of factors leading to cheating, and the relationships of mitigating factors.

In addition to studying the factors already identified that predict or influence cheating behaviors, many new questions come to mind. For example, how do personality characteristics (or disorders) such as low self-esteem, narcissism, etc., impact the propensity to cheat? How does avoiding cheating because of the fear of repercussions differ from avoiding cheating because of higher moral development? If different, is the difference observable? Would policies that promote or reward “whistle-blowing” on peers modify the probability of cheating? Are the factors in the decision to cheat the same for all types of cheating, or does the perceived egregiousness of the act have play in the decision?

It can be observed from existing findings that many significant factors predict the probability of academic dishonesty, but the relationships between such factors and their synergistic interactions have not yet been sufficiently examined. The Meta-Model of Academic Dishonesty will hopefully provide future studies a framework for such questions to be addressed in more statistically rigorous ways.

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TRUST AS A CURRENCY: USING SERIOUS GAMING TO SURVEY SENSITIVE DATA

Stacy Miller, Matt Campbell, and William Glisson

School of Computing, University of South Alabama, 307 N University Blvd, Mobile, AL 36688

The use of surveys for data collection is ubiquitous in many fields, however, it is often criticized for a number of shortcomings including self-report bias, social desirability bias, and low response rates especially in longitudinal studies. Traditionally, surveys were administered in paper format, but the advent of the Internet has enabled researchers to deliver surveys through various online formats [1-3]. While online survey distribution can make the recruitment of study subjects easier on the researcher, the now commonplace announcements of data breaches suffered by both governmental and private companies may lower respondents' willingness to answer online surveys if the questions concern sensitive personal data.

In order to address some of the problems inherent in survey-based data collection, particularly low response rates and social desirability, researchers are evaluating the process of disguising the survey in a game. In the past, gamification has not fared significantly better than other survey methods in all areas, specifically in regards to completion rates and longitudinal stability [4]. The challenges of serious game research are multifactor, and include enticing participants to participate and complete the survey, building a trustworthy platform and being able to cultivate trust with the participant, despite the periodic need for deception and the sensitive nature of research.

This research will examine the concept of trust as a currency in increasing responses to sensitive survey questions in an online game-simulation environment. While the idea of trust as currency is not inherently new, it will be examined in a human-computer interface (HCI) context with an emphasis on current events and other factors involved in the trust-building process. Trust can be examined in two phases, building trust and spending trust, similar to the bid price and asking price of economics. Trust is built gradually, incrementally; and then trust is spent, guiding the decision making process and actions. This research will propose a model for building a trustworthy platform and communicating clearly to the participant in order to build trust. The hypothesis is that serious game simulation has the potential to generate more data than other types of surveys, and that there is a deficiency in current literature at the intersection of computer-mediated interpersonal trust and survey data.

An Analysis of Cybersecurity Requirements in Healthcare

Maureen Van Devender, Matt Campbell and Todd Andel

University of South Alabama

Cybersecurity and securing Protected Health Information (PHI) in the healthcare industry is an increasingly complex challenge. The complexity is caused, not only by an increased use of healthcare technology and increasingly networked systems and medical devices, but also by the myriad of federal, state, local, and professional organizations producing requirements and recommendations for healthcare organizations trying to safeguard PHI. Conflicting and complex requirements can lead to confusion and vulnerabilities for healthcare organizations. There have been many data breaches reported in recent years including the Anthem breach affecting up to 80 million people and the UCLA Health System breach affecting 4.5 million people in 2015.

Recent research has been conducted in the area of conflicting medical regulations. However, these studies are somewhat limited in scope. Maxwell, et. al. [1] identified conflicting software compliance requirements in their research study of the HIPAA Privacy Rule the Gramm–Leach–Bliley Act (GLBA), and the GLBA Financial Privacy Rule. The American society for Healthcare Engineering (ASHE) has identified conflicting requirements in regulations for physical hospital facilities as a major topic in their annual report since 2012 [2].

Data breaches coupled with conflicting and complex requirements generated the idea that various regulation, laws, and standards in healthcare should be analyzed with respect to cybersecurity to determine where there is complementation, conflict, and gaps in coverage. The results provide a basis for further research and analysis that could facilitate the development of recommendations for solutions to address these problems in the future. A Venn diagram visualizes the coverage of regulation, law, and standards with respect to their focus on interoperability and security. Overlapping areas in the diagram represent potential areas of conflict. Gaps between circles represent potential gaps that may lead to vulnerabilities.

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What is the Role of Analytics in doing Business?

Dr. Bob Andrews, Virginia Commonwealth University, randrews@vcu.edu

Karen Bernhard, Capital One,

Mervyn Wright, Altria,

In this session the panelists will describe the current role of analytics in their respective businesses. They will also share their vision of the future of analytics and the knowledge and skills they look for when hiring individuals. They will spend time answering questions from the audience.

**EMPOWERING COLLEGE STUDENTS WITH COGNITIVE DISABILITIES IN A
SPECIAL EDUCATION PROGRAM INTEGRATING E-PORTFOLIO TECHNOLOGY**

James P. Lawler

Pace University

Seidenberg School of Computer Science and Information Systems

163 William Street – 2nd Floor

New York City, New York 10038

lawlerj@aol.com

212-346-1013

ABSTRACT

E-portfolios are becoming common in environments of learning. In this descriptive paper, the author is analyzing the benefits of an e-portfolio system for students with developmental and intellectual disabilities, in a pilot special education program at a leading metropolitan university. The author is finding that the e-portfolio system if included with Web 2.0 technology is enabling increased identity, increased learning and increased sociality of the students. The author is concurrently finding that the essence of the system is facilitating in the formation of marketable skills of these students. This paper will benefit administrators and instructors considering special education programs in which students with developmental and intellectual disabilities can be helped through e-portfolio technology.

EMPOWERING COLLEGE STUDENTS WITH COGNITIVE DISABILITIES IN A SPECIAL EDUCATION PROGRAM INTEGRATING E-PORTFOLIO TECHNOLOGY

E-portfolios are becoming common in environments of learning. In this descriptive paper, the author is analyzing the benefits of an e-portfolio system for students with developmental and intellectual disabilities, in a pilot special education program at a leading metropolitan university. The author is finding that the e-portfolio system if included with Web 2.0 technology is enabling increased identity, increased learning and increased sociality of the students. The author is concurrently finding that the essence of the system is facilitating in the formation of marketable skills of these students. The paper will benefit administrators and instructors considering special education programs in which students with developmental and intellectual disabilities can be helped through e-portfolio.

KEYWORDS: Assistive Technology, College Students with Developmental and Intellectual Disabilities, Electronic Portfolios, Integrated Learning, Special Education Programs

BACKGROUND OF PAPER

An electronic portfolio or e-portfolio can be considered as a "... collection of artifacts or assets [24] ... digital evidence ... efforts, examples or experiences [of a learner] ... objects demonstrating learning ... progress [of a learner] ..." [43] in courses at a university. An e-portfolio can be designed as a content facility archived on diverse media of technology or on the Web [24]. An e-portfolio can document evolving goals and interests if not projects, reports and samples [23] initiated by the learner and document skills [41] learned in periods of semesters. An e-portfolio can have presentations of recognitions, references and resumes and semester services [21]. An e-portfolio is controlled by the learner-student [43] in courses of study at a university.

An e-portfolio can be defined as a constructivist environment of learning focused fundamentally on the student [7]. An e-portfolio enables enhanced identity [25] [33], improved learning [36] and increased sociality [7] of students. An e-portfolio enables learners to formalize individualized meaning from the learning and further inquire in the learning process [8]. An e-portfolio system encourages exchanges of ideas, interactions and inquiries in sociality with professors and other students [24]. The system encourages narratives of personal reflections [40] on results of semesters if not stories [22] that highlight the increased identity [33], increased learning [36] and increased sociality [7] of the students. The system encourages a personalized planning process [17] from the reflections and stories, especially if focused on future potential skills for vocations [39]. The system facilitates a process of sharing and a trail of transparency [30]. In essence, e-portfolio systems form an environment helpful to professors and a journey of learning highly meaningful and personalized to students.

Higher education is expanding inclusion of e-portfolios [3] [44]. Literature indicates 81% of higher education initiatives in the country have on-line learning systems, such as e-portfolio systems, in 2014 [36], as firms in the field market the technology. However, improved identity [33], increased learning [36] and increased sociality [7] of students may not necessarily be a benefit from e-portfolio technology. Meeting the needs of higher education students [14] with a mix of off-line and on-line learning that innovatively integrates e-portfolios in pedagogy is noted in the

literature as a prerequisite to this technology [7]. Not addressed enough in the literature is meeting the needs of special education niche students, notably students with cognitive disabilities, who may benefit from e-portfolio technology and other support tools at a university.

INTRODUCTION TO STUDY

The history of individuals with cognitive disabilities is considered to be of disempowerment and exclusion from higher education if not society. High school students with developmental and intellectual disabilities (IDD) complete schooling not with diplomas but with individualized education plans (IEPs) frequently not recognized by a university. Given the Higher Education Opportunity Act (HEOA) of 2008 and the Individuals with Disabilities Education Act (IDEA) of 2004, however, higher education inclusion programs are expanding for an increasing inflow of students with disabilities having individualized education plans (IEPs) [15] [27] [29]. The programs consist often of courses of learning that contribute employment opportunities [16] and life skills [26] for the students. Students with developmental and intellectual disabilities may be empowered in a special education program [28] through an e-portfolio system and supporting technology tools that may furnish self-advocacy and self-determination [10] for inclusion in society [4] and in the university, as the paper will introduce next.

The Seidenberg School of Computer Science and Information Systems of Pace University is engaging higher-functioning (i.e. less impaired) digitally-literate millennial students with developmental and intellectual disabilities, at the mid-spectrum [45], in a non-degree special education program of 12 courses to be completed by the students in a pilot period of 3 years. The program consists of courses at elementary and intermediate levels and may be of generalized or specialized subjects of study, largely of computer science and information systems topics, with students without disabilities; and concurrently the program consists of extra-curricular experiences in liberal arts events and subjects, also with other students without disabilities. The courses and the experiences correlate to a personalized planning process prepared by counselors of AHRC New York City, a community partner of the university, families of the students and the students themselves, with the planning corresponding to potential vocation visions [12]. The program is modeled on Think College! processes for students with disabilities [13]. The number of students incrementally increasing into the program is 3 in a semester, and from 2010 the number is 12, a norm [38] in programs for this population. The special education program is including e-Portfolio technology for these students with developmental and intellectual disabilities and those without disabilities without distinction.

Each of the students with disabilities is furnished a Mahara (<https://www.mahara.org>) on-line e-portfolio at the university. Functionality is furnished for blogs, in which they may express how they are learning in the courses; journals, in which they may reflect in storytelling on what they are learning in the course disciplines and the extra-curricular events and subjects; and multiple projects, reports and samples, in which they may show what they were learning in the semesters. Information is shared in informal interactions between the professors and the students and between the students themselves [6]. The e-portfolios are essentially electronic resumes of the students with disabilities, ideal for increased identity [33], increased learning [36] and increased sociality [7] of the students, as they progress in the semesters; and they may be evidence of evolving

occupational skills that may match vocation visions. In general, the e-portfolios are considered important in the literature, in increasing the engagement [2] and independence [43] of students with disabilities.

Each of the students is furnished further by the non-profit organization and the university with other supports. They include i-pad productivity tools, such as Everyday Skills, It's My Future and Snipbase, reminder tools, such as Activity Tracker and WatchMinder: Vibrating Watch, and wearables. They include social networking tools, such as Facebook, Flickr, Tumblr and Twitter, ideally increasing learning sharing and opportunity for socialization, and if needed proven speech tools [37]. The students are moreover supported by exemplars – the other students with disabilities, and by expert mentors – the other students without disabilities, in pre- and post-class remedial sessions at the university. The multiple networking spaces of the supports and tools are considered important in the literature [5] as the e-portfolio system, in increasing the identity [33], learning [36] and socialization [7] of the students with disabilities.

In this paper, the author is analyzing the benefits of the e-portfolio system, and the supports and tools, for the students with developmental and intellectual disabilities, at Pace University, in order to confirm or not confirm the literature. Do the features of the e-portfolio functionality enable increased identity [33], increased learning [36] and increased sociality [7] of the students in the special education program?; and do the supports and tools enable increased identity [33], increased learning [36] and increased sociality [7] of the students in the program at the university? Does the system and the tools facilitate formation of meaningful if not marketable skills for these students, as they pursue vocational visions? Few papers have investigated the impacts of e-portfolio technology on higher-functioning students with developmental and intellectual disabilities at the mid-spectrum. This paper will benefit personnel and professionals exploring programs for this population of students that integrate e-portfolios and supporting tools.

FOCUS OF STUDY

The focus of the paper is to evaluate e-portfolio as an enabling environment for the factors in the literature of academic identity [33], learning [36], and sociality [7] of the students with developmental and intellectual disabilities. How do the students perceive the impacts of the system? The paper is also focused on the supports and Web 2.0 tools as an environment in the identity [33], learning [36] and sociality [7] of these students. How do the supports, system and tools improve the showcasing of skills for skills transfer? This study will be beneficial to the profession in pursuing special education programs for a frequently marginalized if not neglected population.

METHODOLOGY OF STUDY

The methodology of the paper evaluated the MAHARA e-portfolio system, and the supports and the tools, of the special education program for the millennial students with developmental and intellectual disabilities, in fall 2013 – spring 2015, in the Seidenberg School of Computer Science and Information Systems of Pace University.

The blog comments, prompted reflections, and interim and final projects, reports and samples entered into the system, by a convenience sample of 5 of the students in 7 of the courses in the program, were evaluated cumulatively in the context of identity [33], learning [36] and sociality [7] of the students, in documentary interpretation [18] by the author and 3 mentors; and in brainstorming focus groups the reflections were evaluated further in the perceptions of the students, in the periods of the 14 semester weeks. The social supports and tools were evaluated in the context of identity [33], learning [36] and sociality [7] by the author and the mentors and by the perceptions of the students, in brainstorming focus groups [34] and in individual semi-structured interviews [20], also in the 14 semester weeks. The impact on learned skills were evaluated in observations, perceptions and semi-structured interviews with the students.

The methodology of the paper was focused mostly on the perceptions of the digital native students with developmental and intellectual disabilities, as they journeyed in the piloting program in the semesters with the e-portfolio technology and the Web 2.0 systems and tools furnished largely by the university.

(The methodology was focused initially in the paper on qualitative results, but quantitative results will be finalized for conference presentation.)

PRELIMINARY ANALYSIS

The preliminary findings of the paper are highlighting benefits in identity, learning and sociality from both the e-portfolio system and the supports and tools.

E-Portfolio System

The consensus of the perceptions of the students with disabilities (5/5 students with disabilities) in the current study is indicating that they are enabled in increased academic identity as members of e-portfolio forums and groups - equivalent in inclusion with students without disabilities. They are enabled in increased learning in evidence from inquiries and posted journal reflections. Evidence of examples of increased creativity and increased critical insight are indicated in the posted reflections on projects and reports. Evidence of examples and of experiences of increased learning of computer science and information systems is indicated in the postings and reflections on syllabi tasks. Narratives of new perspectives are facilitated in the reflections by the e-portfolio space structure.

The students with developmental and intellectual disabilities (1/5) are not discernably enabled in increased sociality, as they leveraged social networking tools instead of the system.

Supports and Tools

The consensus of the perceptions of the students with disabilities (4/5) in the current study is indicating that they are not discernably enabled in increased identity and increased learning through the Web 2.0 social networking tools. They are enabled however in increased socialization through the tools. Evidence of focused and increased collaboration with the other peer students without disabilities and with themselves is indicated in interactions through the tools. These tools are facilitating formation of extra-curricular inclusion of other projects in the school, such as

Django with Seidenberg Hacknight, Gaming in the Cloud Mondays, Scientific American Subscriptions, Seidenberg Computing Nerd Fights with Start-Ups and Summer STEM Conservatory; and occasional student teams.

The consensus of the perceptions of the students (5/5) is indicating that the exemplar and mentor student support is important in ensuring increased identity, increased learning and increased sociality in the semesters. The exemplar and mentor students are encouraging from the knowledge of learning needs the personalized planning of the students with disabilities in the study. The support is facilitating the self-advocacy and the self-determination of the students as bona fide students of the university.

E-Portfolio System, Supports and Tools

The motivation and the passion of the students to be members of the university through the convenience of the e-portfolio system and the support tools are indicated in the observations and reflections to be equivalently important to performance and are indicated in the literature [11] as a prerequisite.

Finally, the performance of the students (5/5) was graded an average of A- cumulatively in the semesters; and a few of the students (2/5) were hired into semi-professional positions as a result of e-portfolio projects, reports and samples that were evidence of skills learned in the semesters [41].

Overall, the students with developmental and intellectual disabilities were pleased with the e-portfolio technology and the Web 2.0 tools that are facilitating their progress in the university.

(Final Analysis of the results will be presented quantitatively for conference presentation.)

PRELIMINARY IMPLICATIONS OF STUDY

The e-portfolio is clearly enabling the students with disabilities in a journey of learning, in the special education program at the school. The formal functionality of the system is engaging them in evidence of increased identity [33] and independence and of increased learning [36] in the semesters. The functionality of options for posted reflections on projects and reports is facilitating the learning process for them, in their semesters at the university. The e-portfolio is formally furnishing learning spaces especially needed for self-study [7] by the students with disabilities. The impact is that the e-portfolio system is giving the students with disabilities an exceptional growth opportunity at the university.

The microblogging and social networking technologies are enabling however interactions in more proactive sharing and sociality [7] for the students with disabilities than the e-portfolio. The Web 2.0 technologies are excellent tools for fostering sociality [7] for the students with disabilities with students without disabilities and with themselves [1]. Those with disabilities are indicated to be highly interested in these technologies [32]. These tools are informally initiating informal information searching and sharing and socialization [7] in learning spaces beyond the e-portfolio. The impact of the social networking tools is that they are giving the students with developmental

and intellectual disabilities further growth opportunities, such that the Web 2.0 tools might be more integrated mechanically into the e-portfolio system at the university.

The millennial students with disabilities are expressing the favorable generic impact of the exemplars and mentors in the program on their identity [33], occupational learning [36] and sociality [7] in the semesters. The education program, and the extra-curricular programs of recreation and socialization, for those with disabilities is partially guided by the mentors, who are often students themselves and who are providing support as pals and tutors. The implication is that the e-portfolio system and the supporting tools might be integrated more procedurally with interventions non-technological for those with developmental and intellectual disabilities.

The e-portfolio system and the supporting technologies are facilitating the formation of marketable skills of the students with disabilities. The learning of meaningful skills is in evidence in grade performance and importantly in the presentation of projects, samples and reports through the structure of the system; and the learning of skills in sociality is in evidence in on-going socialization through the tools. The learning of occupational skills, and even soft skills such as critical thinking, facilitated by the system options and the tools, are in evidence in the semesters in the school. Those with disabilities are helped in their performance of reading, spelling and writing with the system. The implication is that special education programs help students with developmental and intellectual disabilities if integrated with the setting of a system and the tools that provide a structure for them.

Finally, the e-portfolio system is not independent of institutional mechanisms of the university. The involvement of the Office of Disability Services is needed in providing intellectual property and privacy regulations, and standards of Universal Design for Learning and Transition [35], especially for different disabilities and for diverse learning styles of those with disabilities [31]; and the involvement of Technology Services is needed in supporting the system and as practical the tools. The importance of an institutional structure aligned with non-profit organizational support is a prerequisite for pursuing technologies and tools for those with developmental and intellectual disabilities.

LIMITATIONS AND OPPORTUNITIES

The paper is limited by the small sample size of the qualitative study. The paper is limited to the perceptions of students with developmental and intellectual disabilities, without the perceptions of students with other physical disabilities; and the paper reports e-portfolio results from mostly the students themselves. The paper is not reflecting the perceptions of the professors as to e-portfolio intervention results [9] from supporting or not supporting their teaching [42]. Nevertheless, this research-in-progress paper will be helpful to professionals and professors reviewing the potential of this technology, especially with the quantitative study. Innovative supports and technologies [19] will be integral to the teaching of those with disabilities.

CONCLUSION OF PAPER

This paper explores the benefits of an e-portfolio system piloting in a special education program for students with developmental and intellectual disabilities at a metropolitan university. Findings from a limited research-in-progress study highlight increased identity and increased learning from e-portfolio technology and increased proactive sociality from supporting Web 2.0 technologies for the students. Findings further highlight the importance of exemplars and mentors in supporting those with disabilities, as they progress in the program and in recreation and socialization with those without disabilities. This paper highlights the importance of the motivation and the passion of those with disabilities to be learners as members of the program, irrespective of the e-portfolio and supporting technologies. Lastly, this study indicates the potential of the systems and the tools in facilitating skills transfer for vocations. Though more research is needed in reviewing the perceptions of the power of the e-portfolio technology, this study will be helpful to those initially reviewing the technology for a neglected population of society. This study will be helpful moreover to those with disabilities seeking special education programs that are supported by innovative technologies. Overall, this paper presents a study that is timely.

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NOTES ON ACCREDITATION

Robert T. Barrett
College of Business and Public Affairs
Lander University, 320 Stanley Avenue, Greenwood, SC 29649
864-388-8232, rbarrett@lander.edu

ABSTRACT

The accreditation process can be stressful, even for the most seasoned veterans, but especially for those less familiar with the accrediting bodies and accreditation processes. This paper introduces the Southern Association of College and Schools Commission on Colleges (SACSCOC) and the Association to Advance Collegiate Schools of Business International (AACSB) and gives a brief description of the AACSB site visit process.

INTRODUCTION

Universities work to build academic programs of high quality. We recruit qualified faculty and build and update curricula to ensure that our students are getting the best education possible. A number of organizations provide oversight of the quality of the educational institutions. In the south, the Southern Association of College and Schools Commission on Colleges (SACSCOC) monitors the overall workings of universities primarily through an extensive accreditation process. The premier accrediting body for business schools is the Association to Advance Collegiate Schools of Business (AACSB- International). This paper briefly describes SACSCOC and AACSB and gives the mission, vision, core values, and goals of the organizations. You will note the similarities as both organizations strive to promote quality education.

To accomplish and maintain accreditation, universities prepare and maintain extensive documentation of policies and practices that result in quality education. SACSCOC has a major assessment of each accredited university every ten years, with a five year interim report required. AACSB has a five year rotation for site visits. A major stress point for universities is the accreditation visit. Following the descriptions of SACSCOC and AACSB, the discussion moves to describing a typical Peer Review Team Visit by AACSB. It is hoped that this description will help remove some of the stress of the visit for business schools.

SACSCOC

The Southern Association of Colleges and Schools Commission on Colleges is the regional body for the accreditation of degree-granting higher education institutions in the Southern states. It serves as the common denominator of shared values and practices among the diverse institutions in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia and Latin America and other international sites approved by the Commission that award associate, baccalaureate, master's, or doctoral degrees. The Commission also accepts applications from other international institutions of higher education. [1]

Mission Statement: The mission of the Southern Association of Colleges and Schools Commission on Colleges is to assure the educational quality and improve the effectiveness of its member institutions.

Core Values: The Southern Association of Colleges and Schools Commission on Colleges has six core values. They are:

Integrity	Peer Review/Self-regulation	Student Learning
Continuous Quality Improvement	Accountability	Transparency

Vision Statement: To serve as the premier model for shaping and ensuring the quality of higher education throughout the world.

AACSB INTERNATIONAL

The Association to Advance Collegiate School of Business (AACSB-International) strives to support quality management education. As the longest serving global association dedicated to advancing management education worldwide, AACSB accredits 740 of the world's best business schools across 50 countries and territories. The AACSB website lists the following guiding statements and principles: [2]

Mission Statement: AACSB International advances quality management education worldwide through accreditation, thought leadership, and value-added services.

Vision Statement: We aspire to be the world's leading management education authority and association.

Shared Values: In support of our mission, we value:

- operating with a global mind-set in all organizational functions and actions
- providing our services with the highest quality
- collegiality and peer engagement in continuous improvement
- conducting ourselves with the highest level of integrity and mutual respect
- embracing diversity in advancing quality management education worldwide
- conducting ourselves in a socially responsible manner that benefits our local and worldwide communities

Organizational Goal Statements

Goal 1: AACSB advances excellence in collegiate management education through world class accreditation and quality assurance services.

Goal 2: AACSB informs and influences management education stakeholders through research, communication and outreach.

Goal 3: AACSB assists schools of business to address management education challenges and improve quality through an array of comprehensive value-added services.

AACSB STANDARDS

In 2013, the AACSB International Accreditation Council, made up of Deans of accredited schools of business, approved the 2013 Eligibility Procedures and Accreditation Standards for Business Accreditation. These replaced the 2003 Standards under which schools had been assessed since that time. Primary areas of concentration denoted in the Standards (2003 and

2013) center on Strategic Planning, Assurance of Learning (AoL), and Financial Management. Schools develop and adopt a distinctive mission statement and all decisions and actions should be mission driven. In 2013, the AACSB adopted the three themes Innovation, Impact, and Engagement.

THE AACSB REVIEW PROCESS

Continuous Improvement Review (CIR)

Business programs accredited by AACSB maintain accreditation by monitoring programs, measuring outcomes, and recruiting and developing faculty. Accreditation is on a 5-year cycle. The school of business submits the application for reaffirmation of accreditation in the third year of the cycle, 18 months prior to the accreditation visit. The school works with the AACSB staff to identify a group of three deans who will serve as the Peer Review Team (PRT). The PRT members are selected from the school's peer institutions, named in the application process. The Continuous Improvement Review (CIR) report is developed by the school of business faculty and is due to the AACSB office and Peer Review Team 60 days prior to the accreditation visit. The CIR report narrative is limited to 50 pages. Supporting documentation is provided in attachments. The typical report includes these sections: executive summary, situational analysis, strategic planning, faculty, students, assurance of learning, other academic activities, experiential learning, and outreach activities. The narrative is enhanced by supporting documentation, generally presented in tables that are referenced in the narrative. Information on enrollment, faculty qualifications, finances, and curricular activities are a part of the report.

For reaffirmation, after having thoroughly reviewed the CIR report of the school, the Peer Review Team conducts the Continuous Improvement Review in a Sunday afternoon through

Tuesday morning format. The PRT Chair works closely with the school dean to set up a schedule for the visit. The PRT arrives on Sunday afternoon and meets to formalize the strategy for the visit. The school hosts a dinner Sunday evening where the PRT meets advisory board members, university administration, the school faculty, or other groups deemed appropriate.

The major on-site assessment of the program happens on Monday. PRT members visit with senior faculty, junior faculty, students, and various committees (Assurance of Learning, Strategic Planning, and Faculty Qualifications). It is not unusual for the PRT to request information to expand on the narrative in the CIR. A PRT member might look at faculty files to verify qualifications. The PRT may look for evidence of closing the loop activities on findings from the Assurance of Learning assessment. Sometimes a student group or a faculty group is scheduled for lunch. In the late afternoon on Monday, the PRT returns to a work room, typically in the hotel, to write the team's report. On Tuesday morning, the PRT meets with administration, usually the President and Provost, to provide information about the visit and to pass along the recommendation that the PRT will make to the Continuous Improvement Review Accreditation Committee of AACSB.

The PRT Report

The Peer Review Team will write a report detailing the visit and make one of three recommendations:

- Extend accreditation
- Continuous Improvement Review – the PRT names specific items that must be addressed within the next year. A two Dean group reviews the work done by the school and recommends either extending accreditation or a second year under Continuous Improvement Review
- Withdrawal of accreditation – this is rare, but has happened.

The PRT formal report includes a section on areas that must be addressed prior to the next Continuous Improvement Review. Another section discusses the relevant facts and assessment of strengths and weaknesses in support of the team accreditation report. One section of the report identifies commendations of strengths, innovations, unique features, and effective practices of the school under review. A final section lists consultative opportunities for continuous improvement.

Official Notice

If a school receives a positive recommendation from the PRT, the AACSB Board reviews the recommendation and either approves the recommendation or remands back to the Peer Review Team for additional consideration (the latter rarely occurs). The school is informed of Board approval before any formal announcement of accreditation can be made. Accredited schools are recognized at the AACSB International Conference and Annual Meeting (ICAM) held in April.

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- [2] www.aacsb.edu

The Legal Aspect of
Faculty/Student Relationships in Higher Education

Susan B. Shurden

Department of Business Administration
Newberry College, 2100 College Street, Newberry, SC 29108
803-321-5674, susan.shurden@newberry.edu

Robert T. Barrett

College of Business and Public Affairs
Lander University, 320 Stanley Avenue, Greenwood, SC 29649
864-388-8232, rbarrett@lander.edu

Abstract

For as long as institutions of higher learning have existed, issues have arisen as to how to handle the delicate subject of faculty/student relationships. Numerous questions currently exist on the topic of the appropriateness of such relationships, whether consensual or not. Does the issue fall under sexual harassment? How do these relationships occur? Are the students permanently “damaged” by such relationships? What exactly are the legal aspects of such relationships? In an attempt to answer some of the questions, the authors will delve into the laws pertaining to faculty/student relationships. In doing so, one must realize that laws occur because of an idea that something needs to be changed or corrected. However, only Congress can introduce the idea as a bill. It then goes through many processes before being signed into law by the President (Arie, B., 2011). These laws can result from or be the basis for cases that occur between individuals. Additionally, policies are adopted within universities based on laws. The purpose of this paper is to take a closer look at the legal aspect of relationships between faculty and students in higher education, in which laws, as well as cases and policies, will be analyzed.

APPLYING EVIDENCE BASED MANAGEMENT AT THE NORTH CAROLINA AQUARIUM AT FORT FISHER

Catherine Aasen, School of Business and Economics, Fayetteville State University, 1200
Murchison Rd, Fayetteville, NC 28301, 910-795-2281, caasen@broncos.uncfsu.edu

ABSTRACT

This study aids the efforts of North Carolina Aquarium at Fort Fisher to implement evidence-based management techniques by identifying variables that affect the daily net revenue and attendance. The study analyzes 7.5 years (2772 days) of daily data, beginning January 1, 2008 and ending August 31, 2015. Regression analysis identified a number of statistically significant independent variables. Research was conducted at the aquarium to determine daily net revenue based on variable labor costs and average ticket price. Independent variables include: daily average temperature and precipitation, federal holidays, special aquarium events, the New Hanover County School year, Aquarium Free Admission Days, days of the week, seasonal indicators, and year indicators.

EVIDENCE BASED MANAGEMENT

Evidence based management is defined as using evidence to make conscious, explicit managerial decisions. Within evidence based management evidence is divided in two categories, “Big E Evidence” and “little e evidence.” Big E Evidence is generalizable knowledge, while little e evidence is specific to local organizations. “It refers to data systematically gathered in a particular setting to inform local decisions” [26, pp. 260]. A major setback with little e evidence is that the researchers gathering and analyzing data are frequently not the people who will implement managerial decisions. Unless a manager has studied statistics or managerial economics, it is unlikely that they could decipher regression output and then make informed decisions using the data. Research findings need to be translated so that managers can use them to find solutions to organizational problems [26, pp. 267].

This study combines little e evidence and evidence-based principles from Organizational Behavior to produce local evidence that aims to solve specific problems at the North Carolina Aquarium at Fort Fisher. [26 pp. 75] [9 pp. 399].

Evidence based managers follow these steps:

1. Ask a focused question: What is the effect of perceived distributive injustice on part time employees at the North Carolina Aquarium at Fort Fisher? How can this perceived injustice be eliminated or reduced?
2. Acquire the evidence that pertains to that question: Gather information about equity theory and procedural and distributive injustice. Gather local data that pertains specifically to the NCAFF to determine factors that influence daily attendance and net revenue. This is in an attempt to locate profit maximizing/cost saving opportunities from a strategic and/or operational standpoint. Funds can then be reallocated to paying employees fair, livable salaries.
3. Appraise the evidence: Compare evidence found in literature with the specific organizational problem at the aquarium. Run multiple regression analyses to determine the best combination of independent variables. Highlight trends in the data that allow for strategic and/or operational change.
4. Apply it – In this instance the evidence cannot be applied by the researcher. However, the data can be interpreted so that the manager can make informed decisions.
5. Analyze the efficiency and effectiveness of the decision
6. If necessary make adjustments [9 pp. 398].

Using Data to Support Decision Making

There are three levels of managerial decision making; strategic, tactical, and operational. Strategic decision making focuses on policy level decisions, organizational goals and constraints. Tactical decision making focuses on organizational design and resource allocation. Operational decision making focuses on the daily operations of the organization. The aim of this study is to provide the NCAFF with information data to assist with operational and strategic decision making. By tracking daily variables over a 7.5 year period, the analysis allows the aquarium to track trends in attendance and net revenue information on a daily, seasonal, or yearly basis. From an operational standpoint, this data can assist with staffing and scheduling. The data also serves as a tool for making strategic decisions by highlighting trends in attendance and net revenue. There are at least five IT capabilities required by all managers;

1. Word processing
2. Spreadsheets
3. Database management
4. Graphics and statistical analysis
5. Communications

This paper focuses on the use of database management and statistical analysis to determine strategic and operational managerial decisions. In the aquarium study, all raw data was readily available public information, although it was stored over a number of databases belonging to different organizations (NCAFF, NOAA, and New Hanover County). The study uses descriptive statistics to measure central tendency and associational statistics to determine a relationship between variables [21 pp. 147-234].

NORTH CAROLINA AQUARIUM AT FORT FISHER

North Carolina has four facilities in the North Carolina Aquariums Division of the N.C. Department of Environment and Natural Resources. The facilities include three state owned aquariums (Pine Knoll Shores, Roanoke, and Fort Fisher), and Janette's Pier located in Nags Head. In addition to state funding, The North Carolina Aquarium Society is a non-profit, 501(c)3 that supports the three North Carolina Aquariums and Jennette's Pier.

This study focuses specifically on The North Carolina Aquarium at Fort Fisher, although further research can be done at the other facilities. The aquarium maintains a log of daily attendance. Joanna Zazzali, the Visitor and Member Services Coordinator, maintain the records, and uses the data to assist with human resource decisions. Zazzali manages 18 staff members. The staffing of many of these positions is dependent on aquarium attendance. The positions overseen by Zazzali include cashiers, security guards, and aviary attendants. Currently Zazzali is using intuition backed by a small amount of data to predict attendance. By looking at the previous year's attendance and figuring more people will come this year if it's raining, she makes a rough estimate for how many people to staff. If it's forecasted to rain the following day, Zazzali will call an employee and ask if they'd like to work an extra shift. The aquarium mainly uses their attendance data to track growth or declines in attendance patterns. I hypothesize that by utilizing attendance data in addition to a variety of independent variables, a regression analysis can forecast a significant amount of the aquarium's daily attendance. This information can be used by the aquarium to make managerial decisions that are based on evidence rather than intuition.

Inequality at the North Carolina Aquariums

The North Carolina Aquarium system is comprised mainly of full time staff (educators, aquarists, horticulturists, security guards) with part time technicians or assistants. The part time employees are scheduled to work 40 hours a week, and have virtually the same job responsibilities as their full time counterparts. However, to save money, the state hires part time employees on an 11 month temporary basis. They are then laid off for a month and rehired every year. Part time aquarists are paid \$11.52 per hour, and miss one month of work and pay each year. This equals roughly \$22,118. Additionally, part time employees are not granted any of the state benefits allowed to full time employees. The job posting states, "This is an hourly position with schedule of 40 hours per week for 11 months. It is classified as temporary/part-time and does not include state benefits" [24].

Full time aquarists are hired within the \$33,001 – \$34,466 range, with possibility of advancing to \$50,881. Similar wages discrepancies are found within the education and security departments as well. As Latham says, "Few things kill an employee's motivation faster than perceptions of injustice" [18 pp. 92]. While the aquarium does a good job hiring intrinsically motivated employees who are truly passionate about their work, part time employees quickly lose organizational commitment. They lose satisfaction with their job, feel underappreciated, and lose motivation. Because of the nature of the aquarist position, decreasing work quality is not always an option. Animals must be cared for regardless of job satisfaction. This leaves many part time aquarists in a difficult situation determining how to balance inequality. Many are constantly looking for new jobs in an attempt to "leave the field" [22 pp. 135-158] [6, pp. 396-424] [16].

JUSTICE AND EQUITY THEORY

In *Work and the Nature of Man* [16] Herzberg and Gedrick report that perceived inequality in the workplace is the leading cause of job dissatisfaction. Leon Festinger's [10] studies on cognitive dissonance theory and George Homans' [17] ideas on distributive justice paved the way for J. Stacy Adams' [1] [2] [3] formation of equity theory. Pay satisfaction is affected by procedural justice and distributive justice. Procedural justice relates to fairness regarding *how* an employee is paid, while distributive justice relates to fairness regarding *what* an employee is paid. Fairness in compensation is paramount to job satisfaction [28 pp. 108-109] [30 pp. 7] "People want to know that the 'system' for administering pay is effective, fair, and inclusive" [19 pp. 6].

Equity theory claims that a person (Person) will compare the ratio of his inputs and outputs, to the ratio of inputs and outputs of another (Other). If Person perceives that he has the same inputs as Other, but Other's outputs are higher, Person will be dissatisfied, and may lose motivation to work. Likewise, Other may feel guilt for being rewarded more heavily than Person. The presence of perceived inequality will motivate a person to reduce inequality. Adams [3] proposes eight possible actions to reduce inequality.

1. Person may increase his inputs if they are low relative to Other's inputs and to his own outcomes.
2. Person may decrease his inputs if they are high relative to Other's inputs and to his own outcomes.
3. Person may increase his outcomes if they are low relative to Other's outcomes and to his own inputs.
4. Person may decrease his outcomes if they are high relative to Other's outcomes and to his own inputs.
5. Person may "leave the field" when he experiences inequity of any type.
6. Person may psychologically distort his inputs and outcomes, increasing or decreasing them as required.
7. Person may increase, decrease, or distort the inputs and outcomes of Other's, or force Other to leave the field.
8. Person may change his referent Other when inequity exists. (Adams 1965)

A number of studies have been conducted that show the effects of perceived unfair pay practices and the relationship between procedural and distributive justice [5] [1] [2] [4]. Studies show that distributive justice correlates more directly with pay satisfaction than does procedural justice. [11 pp. 115-130] [23 pp. 626-637] [29 pp. 285-299]. Furthermore, if employees perceive distributive injustice, but are given a valid explanation for the inequality (via procedural justice), they were more accepting of the inequality [12] [13] (22 pp. 135-158).

MASLOW'S HIERARCHY OF NEEDS

Latham provides a five-point checklist on Maslow's Hierarchy of Needs as it relates to employment. The needs include; physiological needs, security, affiliation, self-esteem, and self-actualization. The problem with the aquarium lies in the unfulfilled need for security. "In the work setting, the need for safety goes beyond physical safety to include job protection (for example, tenure, a union contract, as well as the desire for a savings account and for insurance (for example, health, unemployment, disability) [18 pp. 79].

Humans are safety-seeking. When the need for safety (security) is not met, they will focus solely on obtaining it. At this point, it is not possible to attain higher needs of affiliation, self-esteem, or self-actualization [20 pp. 39-41]. Not only does the aquarium's human resource practice invoke perceptions of inequality amongst employees, it also hinders part time employees from fulfilling the basic human need of security. This need must be met to produce motivated, high performing employees.

Evidence

Evidence to support the claim that part time employees (T-1s) at the NCAFF are dissatisfied with their jobs can be found in testimonials from current employees and former employees.

The absence of security is apparent in this quote given by an employee at the NCAFF. Additionally it discusses the psychological effects of perceived inequity, describing it as "demoralizing."

"I qualified for food stamps working at the North Carolina Aquarium at Fort Fisher. Every time I would go food shopping, I would wear my uniform so that people would know that I work for the state. They have been promising to change us over to full time for 3 years and now it's on hold indefinitely. The state is giving a "bonus" to state employees of \$750. T1s get zero. It is demoralizing to do the same things as full-time employees and get slave wages. I have had to go to the food pantry several times and it is so embarrassing to be handed food from people you go to church with because your job doesn't pay you enough to live."

Another aquarium employee discusses giving up their dream job, because the pay wasn't enough to cover the bills, and because inequity left them feeling underappreciated.

"I used to say I would never work to live and only live to work. Working for NC State Aquariums changed all that. After working there for 5 1/2 years, I was forced to leave my dream job. The cost of living went up and my pay check stayed the same. To top it all off, the last 3 years I was there, I was laid off for 31 days every 11 months. I applied for unemployment, but there was a delay in getting those checks. For 4 weeks out of the year, it became hard to pay the bills and put food on the table. It was my dream to be an animal caretaker, so I did this for 3 years in hopes the state would add more full time positions in husbandry. I had the same responsibilities, education and experience as a full time worker in husbandry. I just didn't have a salary or benefits. I left when I realized there wasn't going to be any advancements or appreciation for the work I put in."

THE STUDY

This study looks to identify independent variables that affect the North Carolina Aquarium at Fort Fisher's (NCAFF) daily guest attendance and daily net revenue. Additionally, the study will allow the aquarium to forecast daily attendance, which will aid in staffing decisions. Both aspects of the study are designed to provide the aquarium with data so that they can implement cost saving opportunities, in the hopes that the state will be able reallocate funds for paying employees fair, livable salaries.

The study includes 7.5 years of daily values, beginning January 1, 2008 and ending August 31, 2015. The independent variables in the study include daily average temperature and daily precipitation, as reported by the National Oceanic and Atmospheric Administration (NOAA) at the Wilmington International Airport data collection station. Other independent variables include federal holidays (Washington's Birthday, Memorial Day, Independence Day, Labor Day, and Columbus Day). Thanksgiving and Christmas are not included in the study, as the aquarium is closed on these days. The aquarium began opening on New Year's Day in 2014, so it is excluded from the previous years' data. Additionally, the aquarium offers free admission on Martin Luther King Jr's birthday and Veterans Day, so those days are counted as Free Days instead of holidays. The effects of aquarium events, the New Hanover County School year, Aquarium Free Admission Days are studied using dummy variables, as well as the relationship between weekends and week days, and seasonal factors. All days in which the aquarium was closed for business were removed from the study, including the before mentioned holidays, hurricane and snow days. With the removal of closed days, the study covers a total of 2774 days (See Tables 1a and 1b). Daily net revenue and daily attendance are forecasted using regression analysis on SAS Statistical Software program, version 9.2. Four regressions were run using Net Revenue as the dependent variable, and four regressions were run using attendance as the dependent variable (See Appendix 1). All results are compared to the base day. The base day for the analysis is:

- Monday
- Winter
- Year 2008
- New Hanover County schools are in session
- Zero precipitation
- Not a holiday
- Not a free day

TABLE 1a

Variable Summaries

Dependent Variable Summary	
Daily Attendance at the North Carolina Aquarium at Fort Fisher	The total daily attendance from January 1, 2008 – August 31, 2015. Data was collected from the North Carolina Aquarium at Fort Fisher Admission Department.
NetRev	Net Revenue is calculated by subtracting the average variable labor cost per day from the average ticket revenue per day

Independent Variables Summary	
Average Temperature (Fahrenheit)	Average Temperature data was collected from NOAA. Data was recorded at the Wilmington International Airport data collection center.
Precipitation (inches)	Precipitation data was collected from NOAA. Data was recorded at the Wilmington International Airport.
Holidays	Washington’s Birthday, Memorial Day, Independence Day, Labor Day, and Columbus Day
Aquarium Events	Events hosted by the North Carolina Aquarium at Fort Fisher
New Hanover County School Year	School is in session compared to when school is out for the summer
Free Admission Days	The aquarium offers two free admission days per year: Martin Luther King Junior’s Birthday and Veterans Day.
Weekends	Weekends compared to weekdays
Tuesday, Wednesday, Thursday, Friday	Days are compared to Monday
Season	Summer, Spring, and Fall data are compared to that of Winter
2009, 2010, 2011, 2013, 2014, 2015	Individual years are compared to 2008
TimeVariable	Looks at growth from 2008-2015 from a linear perspective

TABLE 1b**Descriptive Statistics**

Variable	N	Minimum	Maximum	Mean	Median	Std
Obs	2772	1	2772	1386.5	1386.5	800.3518
Attendance	2772	0	7031	1191.04	957.5	939.9074
TickRevDay	2772	0	62950	11720.71	9435	9170.2
LabCostsDay	2772	1257.6	2103.68	1715.58	2103.68	406.9064
NetRev	2772	-2103.68	61692.4	10005.13	7702.44	8899.35
AvgT	2772	23.09	90.95	64.27183	66.47	14.78103
Pcpn	2772	0	10.33069	0.151211	0	0.491251
Holiday	2772	0	2	0.018398	0	0.13707
Event	2772	0	1	0.010462	0	0.101765
School	2772	0	1	0.799062	1	0.400774
FreeDay	2772	0	1	0.005051	0	0.0709
Weekend	2772	0	1	0.286436	0	0.452177
Monday	2772	0	1	0.144661	0	0.351822
Tuesday	2772	0	1	0.1443	0	0.351457
Wednesday	2772	0	1	0.144661	0	0.351822
Thursday	2772	0	1	0.144661	0	0.351822
Friday	2772	0	1	0.141775	0	0.348882
Summer	2772	0	1	0.257215	0	0.437178
Spring	2772	0	1	0.26443	0	0.441109
Fall	2772	0	1	0.227634	0	0.41938
Y2009	2772	0	1	0.12987	0	0.336221
Y2010	2772	0	1	0.130952	0	0.337409
Y2011	2772	0	1	0.130592	0	0.337014
Y2012	2772	0	1	0.130231	0	0.336618
Y2013	2772	0	1	0.130592	0	0.337014
Y2014	2772	0	1	0.130231	0	0.336618
Y2015	2772	0	1	0.087302	0	0.282327
Year	2772	1	8	4.349928	4	2.21886
MaxT	2772	31.1	102.92	74.23394	77	14.31632
MinT	2772	13.1	80.96	54.30972	55.94	15.90805

Literature Review

After an extensive literature review, it does not appear that research of this kind has been conducted before. Research pertaining to museum, aquarium, and zoo attendance focuses highly on ticket prices, and new exhibits and attractions. Journalists, curators, and academics have speculated about the effect of weather and the school year on attendance [14] [8]. David Richard Perkins IV [25] wrote a master's thesis on, "Forecasting Tourist Decisions Regarding Zoo Attendance Using Weather and Climate References." The thesis examines how climate patterns affect attendance at thirteen zoos. Attendance patterns are believed to be similar at zoos, aquariums, and museums, so the thesis is of relevance to the current study. However, the NCAFF study takes an in depth look at how a variety of factors, including weather, affect a specific organization.

Results

Before running a regression, it is important to run a correlation analysis to determine if any independent variables are correlated to one another. Highly correlated independent variables jeopardize the integrity of the analysis. None of the independent variables in the study were highly linearly correlated ($r > 0.70$). Only three combinations of variables were moderately linearly correlated (see Table 2). All other variable combinations had low levels of linear correlation.

TABLE 2

Correlation Analysis	
Summer/School	$r = 0.66$
Summer/Avg T	$r = 0.62$
School/Avg T	$r = 0.51$

A total of eight regression analyses were performed over two dependent variables. Four analyses were performed to determine the factors affecting daily attendance, and four analyses were performed to determine the factors affecting daily net revenue. For both dependent variables, adjusted r square was maximized when using average temperature and yearly dummy variables as independent variables (see Tables 3a and 3b). All variables were statistically significant over a 95% confidence interval, with the exception of year 2011, which was not statistically different from the base year.

TABLE 3a

Net Revenue Regression Results

Dependent Variable:	NetRev							
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Variable Name	Parameter	Parameter	Parameter	Parameter	Estimates	Estimates	Estimates	Estimates
Intercept	5684.062 **	6069.595 **	6179.116 **	6686.502 **				
Tuesday	1352.99 **	1323.084 **	1366.421 **	1337.069 **				
Wednesday	1330.91 **	1295.41 **	1336.315 **	1301.638 **				
Thursday	1688.704 **	1661.3 **	1677.062 **	1650.08 **				
Friday	2135.737 **	2082.679 **	2133.744 **	2080.181 **				
Weekend	57296.59 **	5703.042 **	5718.527 **	5691.589 **				
Summer	6991.022 **	7110.581 **	7543.353 **	7719.235 **				
Spring	6412.214 **	6411.73 **	6778.002 **	6815.786 **				
Fall	-910.946 **	-906.631 **	-712.943 **	-686.198 **				
School	-8558.68 **	-8355.7 **	-8658.27 **	-8439.87 **				
Event	4458.394 **	4485.717 **	4418.74 **	4442.686 **				
Holiday	7768.027 **	7735.206 **	7788.767 **	7757.087 **				
FreeDay	-4874.91 **	-4862.96 **	-4959.34 **	-4952.89 **				
AvgT	54.23057 **	55.01701 **	-----	-----				
MaxT	-----	-----	37.24429 **	36.06527 **				
Pcpn	1585.268 **	1580.722 **	1662.677 **	1658.769 **				
Year	-----	181.851 **	-----	182.4426 **				
Y2009	1901.842 **	-----	1935.666 **	-----				
Y2010	1162.502 **	-----	1147.549 **	-----				
Y2011	756.2202	-----	764.9664	-----				
Y2012	2040.823 **	-----	2081.681 **	-----				
Y2013	2460.099 **	-----	2480.075 **	-----				
Y2014	1184.119 **	-----	1191.838 **	-----				
Y2015	1926.355 **	-----	1923.725 **	-----				
n	2772	2772	2772	2772				
F (p-value)	229.89 (p<0.0001)	315.44 (p<0.0001)	228.49 (p<0.0001)	313.28 (p<0.0001)				
Adjusted R-square	0.6343	0.6299	0.6329	0.6283				
SER	5381.56	5413.822	5392.066	5425.603				

Note: ** = statistically significant at alpha = 0.05

TABLE 3b

Attendance Regression Results

Dependent Variable: Attendance

Variable Name	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	Parameter		Parameter		Parameter		Parameter	
	Estimates		Estimates		Estimates		Estimates	
Intercept	700.5092	**	738.3769	**	740.4995	**	790.7389	**
Tuesday	118.9968	**	116.1584	**	120.3448	**	117.552	**
Wednesday	111.775	**	108.3857	**	112.2186	**	108.9033	**
Thursday	147.7977	**	145.1564	**	146.4419	**	143.8526	**
Friday	191.0098	**	185.88	**	190.7422	**	185.5581	**
Weekend	559.1552	**	556.5782	**	557.9593	**	555.346	**
Summer	762.8158	**	776.6736	**	817.6932	**	835.9758	**
Spring	706.03	**	706.6736	**	741.3147	**	745.6766	**
Fall	-114.727	**	-113.343	**	-95.6315	**	-92.0847	**
School	-850.675	**	-828.943	**	-860.286	**	-838.967	**
Event	490.9332	**	494.5134	**	487.0726	**	490.3823	**
Holiday	764.1861	**	760.9348	**	766.1496	**	763	**
FreeDay	3257.738	**	3258.923	**	3249.353	**	3250.013	**
AvgT	5.80547	**	5.84481	**	-----	**	-----	--
MaxT	-----	--	-----	--	4.19058	--	4.03847	**
Pcpn	148.8615	**	148.5816	**	157.1497	**	156.883	**
Year	-----	--	18.67389	**	-----	--	18.72355	**
Y2009	186.3492	**	-----	--	190.1487	**	-----	--
Y2010	119.236	**	-----	--	117.7503	**	-----	--
Y2011	72.61974		-----	--	73.29604		-----	--
Y2012	191.2899	**	-----	--	195.3334	**	-----	--
Y2013	252.2178	**	-----	--	254.3626	**	-----	--
Y2014	125.187	**	-----	--	125.9894	**	-----	--
Y2015	189.3364	**	-----	--	189.483	**	-----	--
n	2772		2772		2772		2772	
F (p-value)	248.15	(p<0.0001)	341.43	(p<0.0001)	246.73	(p<0.0001)	339.24	(p<0.0001)
Adjusted R-square	0.6519		0.6482		0.6506		0.6468	
SER	554.5183		557.4566		555.5595		558.6237	

Note: ** = statistically significant at alpha = 0.05
Table 3.

Limitations

Limitations of this study include external variables that may skew the data. For example, in June 2015 there were multiple shark attacks on the North Carolina coast. With high temperatures, and a fear of entering into the water, many beach goers in the vicinity spent time at the aquarium instead of sitting on the hot sand. This resulted in abnormally high attendance levels during June. Another limitation is that the meteorological data is collected 25 miles away from the aquarium, at NOAA's closest data collection station. Having precipitation and temperature data collected more closely to the aquarium would improve the study. Additionally, other variables can be examined for correlation to strengthen the study.

Although it is public information, the aquarium was hesitant to give out information related to the number of part time employees, their working hours, and salaries. The business manager at the aquarium gave a false account of the number of part time employees and their hours. Further investigation showed that the actual numbers were roughly twice what were originally reported. When the business manager was asked to confirm the numbers, she instructed all aquarium staff to cease communications regarding the study. Therefore, the net revenue in the study is a close estimate. With accurate information on variable labor costs, the study would be strengthened.

CONCLUSION

The state of North Carolina should create a system that promotes equality among employees, and that satisfies the basic human need of security. As evidence suggests, once this happens, productivity and workplace moral will soar, and turnover will decrease. This study provides the aquarium with factors that determine daily attendance and net revenue. With this evidence, the aquarium can make strategic and operational decisions that allow for smarter staffing and scheduling decisions, marketing decisions, and identify areas for strategic growth. Managers at the aquarium or at the state level can use this information to locate profit maximizing/cost saving opportunities from a strategic and/or operational standpoint. Funds can then be reallocated to paying employees fair, livable salaries.

APPENDIX

Appendix 1 - SAS Program Code

```
/*
SOFTWARE: SAS Statistical Software program, version 9.2
AUTHOR: Catherine Aasen, October 7, 2015.
TITLE: Program to analyze NC Ft. Fisher Aquarium data.
*/

options helpbrowser=sas;
options number pageno=1 nodate nolabel font="SAS Monospace" 10;
options leftmargin=1.00 in rightmargin=1.00 in ;
options topmargin=1.00 in bottommargin=1.00 in;

/* Proc Import brings Excel data file OLSdata.xls into SAS and gives it the new name dataset01. The dataset has 26
observations on three variables, Y, X1 and X2. */

proc import datafile="v:\chris\AasenDataSAS.xls" dbms=xls out=dataset01 replace;

/* The Proc Reg command can be used to do OLS regressions. For example, the model statement below requests a
regression using Y as the dependent variable and X1 and X2 as independent variables. */
/* Baseline Model: Friday, Winter, 2008 */

proc reg data=dataset01;
model NetRev = Monday Tuesday Wednesday Thursday Weekend Summer Spring Fall
School Event Holiday Freeday AvgT Pcpn Y2009 Y2010 Y2011 Y2012 Y2013 Y2014 Y2015 ;
model NetRev = Monday Tuesday Wednesday Thursday Weekend Summer Spring Fall
School Event Holiday Freeday AvgT Pcpn Year ;
model NetRev = Monday Tuesday Wednesday Thursday Weekend Summer Spring Fall
School Event Holiday Freeday MaxT Pcpn Y2009 Y2010 Y2011 Y2012 Y2013 Y2014 Y2015 ;
model NetRev = Monday Tuesday Wednesday Thursday Weekend Summer Spring Fall
School Event Holiday Freeday MaxT Pcpn Year ;
run;
```

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CONFESSIONS OF A SHOPAHOLICS. THE VALUE OF LUXURY BRANDS ON SOCIETY.

Esmira Gheisary, Savannah State University, 3219 College Street, (904) 861-7778,
esmira_g@hotmail.com

ABSTRACT

Following study focuses on the analysis of luxury and its major definitional and conceptual issues into the Fashion industry. With a rising globalization and daily changing economy, luxury brands play a vital role in political, social and business spheres by fulfilling people's physical and psychological needs. This research provides a framework for investigation the consumption and management of luxury on today's society. Further it examines the different consumers' perspective of luxury, known as "semi-luxury" and its impact to the market. The aim of particular research is to give a sense of characteristics of luxury and semi-luxury brands for academics and practitioners in the luxury fashion industry as it involves findings from focus group, one-to-one interviews, and online surveys. Finally the paper offers insights and pointers for future research.

KEY WORDS

Luxury fashion brands, Brand names, Brand attitudes, Emotional Attachment, Engagement.

1. Introduction

Luxury can be compared to beauty in the sense that luxury (beauty) lies in the eyes of the beholder. One man's trash can often be described as another's treasure and vice versa. When breaking down where luxury and necessity (Bearden and Etzel, 1982) divides, we have three tiers of living to analyze; there's the bare necessities of life, the minimum amount to achieve basic happiness, and then there's the point of material euphoria that is often reserved for the wealthy and rich (Meyers, 1890). Understanding what is and not considered luxury will be impacted by situational relativity, temporal relativity, regional relativity, and economic relativity; all of which describes the time, place, culture, and financial standing of those giving their definition of luxury (Buttner, 2006; Nyeck, 2004; Valtin, 2004). When determining luxury, all aspects should be analyzed under normal conditions, and never on individual cases. We often see luxury as having more than enough and being over the top to satisfy a need, but sometimes being balanced across the board is a point of being wealthy in itself. The desire for wealth and luxury is often fueled by each individual's own greed and desire to be envied (Berthon, 2009).

Philosophical-sociological understanding of luxury brings us into the realm of the intangibles and broadens luxury into all that is desired, whether it is tangible or not (Berry, 1994; Sombart, 1922). Some examples that often fall within this category are talents, gifts, and love; everything desired is luxury (Sombart, 1922). From the micro-economic aspect of luxury, the focus shifts to the direct relationship between price, income (Chaudhuri, 1998), demand and availability within that given market (Deaton and Muellbauer, 1980; Poll, 1980). The economic side of things shows us how the demand can drive the price up, but depending on the financial class, it may or may not be considered a luxury due to the amount of income. Ultimately availability determines its luxury value, because if something is rare and demanded, then it is luxurious (Meffert and Lasslop, 2003). Managerial understanding of

luxury breaks down how a company can market itself as a luxury brand by only focusing on the small consumer market that can realistically purchase its products (Matthiesen and Phau, 2005). Companies such as Gucci, Louis Vuitton, and Bentley are examples of companies that focus on the consumers that are in the upper financial class, and have the deposable income necessary to buy their product. Determining how to or who to market to is a major question, so many companies rely on consumer behavioral studies (Dubois and Czellar, 2002; Heine 2009) to determine which products to market and which consumers to market them to. It all comes down to understanding preferences, demographics (Dubois and Duquesne, 1993), culture (Casaburi, 2010), and situational factors (Dubois and Laurent, 1996) are present. They keep their positions as luxury companies by not lower prices and not flooding the markets with their product, and in return they remain rare and demanded.

A brand is the image (Esch, 2010) that consumer thinks of when they think of a particular company. Some brands are viewed as cheap and in expensive, while others are viewed as a better quality and expensive (Kapferer, 2008). Expensive brands are nearly always associated with luxury (Meffert and Lasslop, 2003). They make up some of the most desired and rare products in the world. Their prices can sometimes reach as much as 100 times more than the cheap and inexpensive counterparts. Some luxury brands also offer more affordable products that are still considered luxury in other financial classes (Kapferer and Bastien, 2009). Often times this is an attempt to become a realistic luxury name within other classes outside of the wealthy and rich. An example would be Maserati, who offers a semi affordable luxury sedan starting at \$65,000 and also a high-end \$2.2 million car for the wealthy and rich.

The brand's identity (Aaker, 1997) determines how the brand will be viewed in a given market. By promoting certain products at a particular price to specific consumers, brands are able to establish their identity (Esch, 2010; Kotler, 2009). It lets the world know

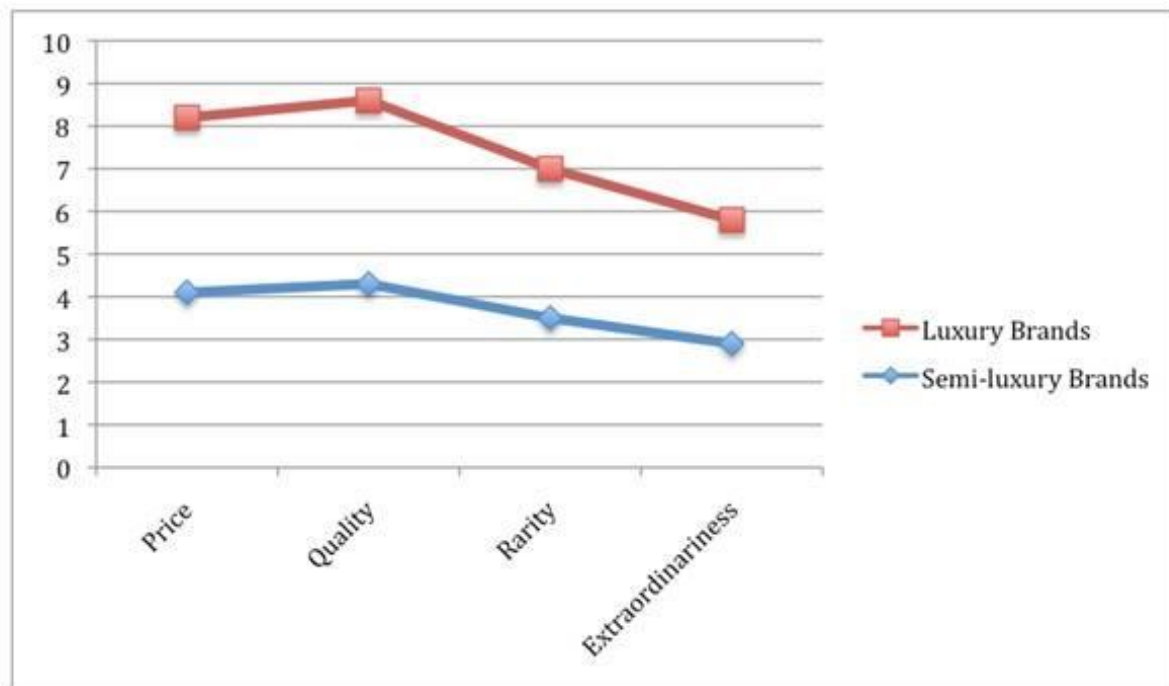
what they stand for, and it distinguishes it from the other brands. The two main components that identify a brand's identity are the physical and the abstract components (Kapferer, 2008), with the physical being the quality and everything tangible associated with the product and the abstract being the intangible image that is associated with the brand. There's also an emotional connection (Aaker, 1997) that is often made between a brand and the consumers, and in some cases there's a loyalty (Heine and Trommsdorff, 2010) that goes far beyond the normal thought. An example that is commonly used would be between Apple and its customers, because they often become emotionally attached to their products.

This research focuses on defining luxury, luxury brand types and analyzes the luxury brand type – engagement – attitude framework for gauging consumers' perception and responses towards luxury brands. The next section, literature review, describes in depth about luxury and non-luxury brands, types of luxury brands, and consumer engagement-attitudes nexus towards luxury branding.

2. Literature Review

2.1 Luxury Versus Semi-Luxury Brand

The definition of luxury is often broad and can easily be interpreted as vague. For the sake of conversation and studies, the general measuring stick used to determine which items can be deemed luxury is separated into four categories: Price, rarity, extraordinariness, and quality (Kromrey, 2009). Not all luxury brands score high in all categories when measured, therefore there's a wide variety of luxury brands (Kapferer and Bastien, 2009); those that measure as luxury in a given category are often times much higher than the next best item in that particular category. As a result there are semi-luxury brands that exist, which are shown on the figure 1, and these brands are known as premium and masstige brands, and they also score high when measured on the luxury scale.

Figure 1.: Luxury Brands vs Semi-Luxury Brands**Figure 1: Heine K. (2010)**

Premium brands and products are high quality items that are more common, affordable, and appeal more to the masses than luxury brands and products (Kapferer and Bastien, 2009). Though premium brands score high on the luxury scale, they do not score within close proximity to luxury brands. For example, the Ritz Carlton in comparison to the Hyatt and the Holiday Inn (Murphy, 2011) would be considered as a luxury, while the Hyatt would stand as the premium, and the Holiday the masstige.

A masstige brand is often a brand that falls somewhere between luxury and non-luxury. Brands that fall into this category tend to offer a high quality product or service to the masses. With affordable pricing, masstige products are typically seen as a more practical buy for those looking to budget (Kapferer and Bastien, 2009). Where they lack in quality and rarity, they typical make up with lower prices and are usually readily available. Masstige

products are generally marketed more towards the middle class than any other class.

Examples of masstige brands are companies such as Olive Garden, Victoria Secret, or Target.

2.2 Types of Luxury Brands

Luxury brands are broken down into different ranks and categories based off of quality, price, and rarity (Kromrey, 2009). The brands are separated into entry-level brands, connoisseur brands, star brands, and elite brands (Hieu-Dess and Esteve, 2005). Entry-level brands are more affordable and less rare, while the elite brands set standard for how luxury is to be measured. Elite level brands are often priced much higher than any other brand types of brands, and can usually consist of some most rare services and products. Brands that would fall under the entry-level would be brands such as Ralph Lauren, Lacoste, or Express (Kapferer and Bastien, 2009). Elite level brands would be Chanel and Harvard, in their respected categories.

Connoisseur brands (Nueno, 1998) specialize in niche markets are often not known outside of the small market. These brands usually specialize in a specific service or product, and are considered the standard in their field. Star brands are much different from connoisseur brands in the way that they advertise and strive to appeal to as many as possible. Those outside of their target group usually know brands that are considered star brands; they are household names. Starbucks is an example of a star brand; coffee drinkers and non-coffee drinkers alike know it.

Consumers develop different types of feelings towards brands based off on how the brand is marketed and how they actually receive it (Barthes, 1971). This is seen as the foundation for the initial engagement between the consumer and the brand; first impressions are everything. Some brands come across to consumers as down to earth everyday brands, while others seen as rarity, and depending on financial status, even farfetched. However, some

customers are willing to pay more than they can actually afford, because of a personal attachment that has been forged between the consumer and the brand.

2.3 Prototypical Brands

The prototype theory implies on the knowledge about a certain category that is represented by an abstract prototype in form of a list of typical attributes (Hoffman, 1986). In the minds of consumers it can be the brand that in essence defines the central representation of a category, in other words, possessing the average or modal value of attributes of that category. Often, consumers prefer prototypical brands rather than less-prototypical brands (Barslou, 1985). The reason they prefer more prototypical brands is because these brands are ready to offer more attributes characteristic of the category. Moreover, these attributes are more favorable and valued. And what's more important these prototypical brands are the origins of that certain category and therefore they are more recognizable and preferred (Gordon and Holyoak, 1983). These brands have the advantage to build brand loyalty among their consumers and become the leader of that category. For example, Levi jeans are the leader in the jeans industry, as well as Coca-Cola is the leader and "first-comer" in soda selling. To picture it more, when you think of some type of product category, you will first think of such brand that represent it and that is what we call prototypical brands. For most of the people, when they think of luxury cars, they tend to imagine Rolls Royce due to its luxury attributes, characteristics and standing itself as the leader in its category. Whatever the case, consumers perceive the category prototype as representative of the entire product category.

3. Conceptual Framework and Hypotheses

The luxury fashion industry is believed to be one of the most profitable industries in the world (more than US\$252 billion annually (The Economist, 2012)). Therefore, luxury fashion brands help develop the best luxury fashion products for the market. Due to the importance and high profitability of the fashion industry, consumers' perceptions of luxury

and semi-luxury brands along with the motivation as a driving force for consumers to purchase high-end products need to be examined.

Luxury fashion industry consists of luxury and semi-luxury brands. Semi-luxury brands are those that do not reach the highest level of satisfaction as luxury brands, but they are above the line of something that is considered more than necessary. The results of the investigation related to the consumers' purchasing power for luxury fashion brands are of major importance for the research. They reveal that the intention to purchase fashion products is determined by the consumers' behavior towards luxury and semi-luxury fashion brands. According to Gentry, Putrevu and Shultz (2006) consumers consider semi-luxury fashion brands to be the best alternative for the luxury brands due to the lower prices but same quality of goods. Keeping up with the latest fashion trends gives the consumers more satisfaction when purchasing the semi-luxury brands as well. The following hypothesis will determine the cause and effect relationship between the consumers' behavior and consumers' engagement:

H1: Consumers' behavior towards luxury and semi-luxury brands has a direct effect on the consumers' engagement towards brands.

Value consciousness is defined as a "concern for paying lower prices, subject to some quality constraint" (Lichtenstein Netemeyer and Burton, 1990). Most buyers of luxury fashion brands pursue prestige and image benefits, but may be unwilling to pay a higher price for it. For a lower price and a slightly substandard quality, semi-luxury brands are still considered "value for money" (Zhang and Ouyang, 2005). Thus, a positive relationship is predicted between value consciousness and attitude toward luxury and semi-luxury fashion brands. Based on the discussion above, the hypothesis is:

H2: Consumers' value of luxury and semi-luxury brands has a direct effect on the consumer's engagement towards brands.

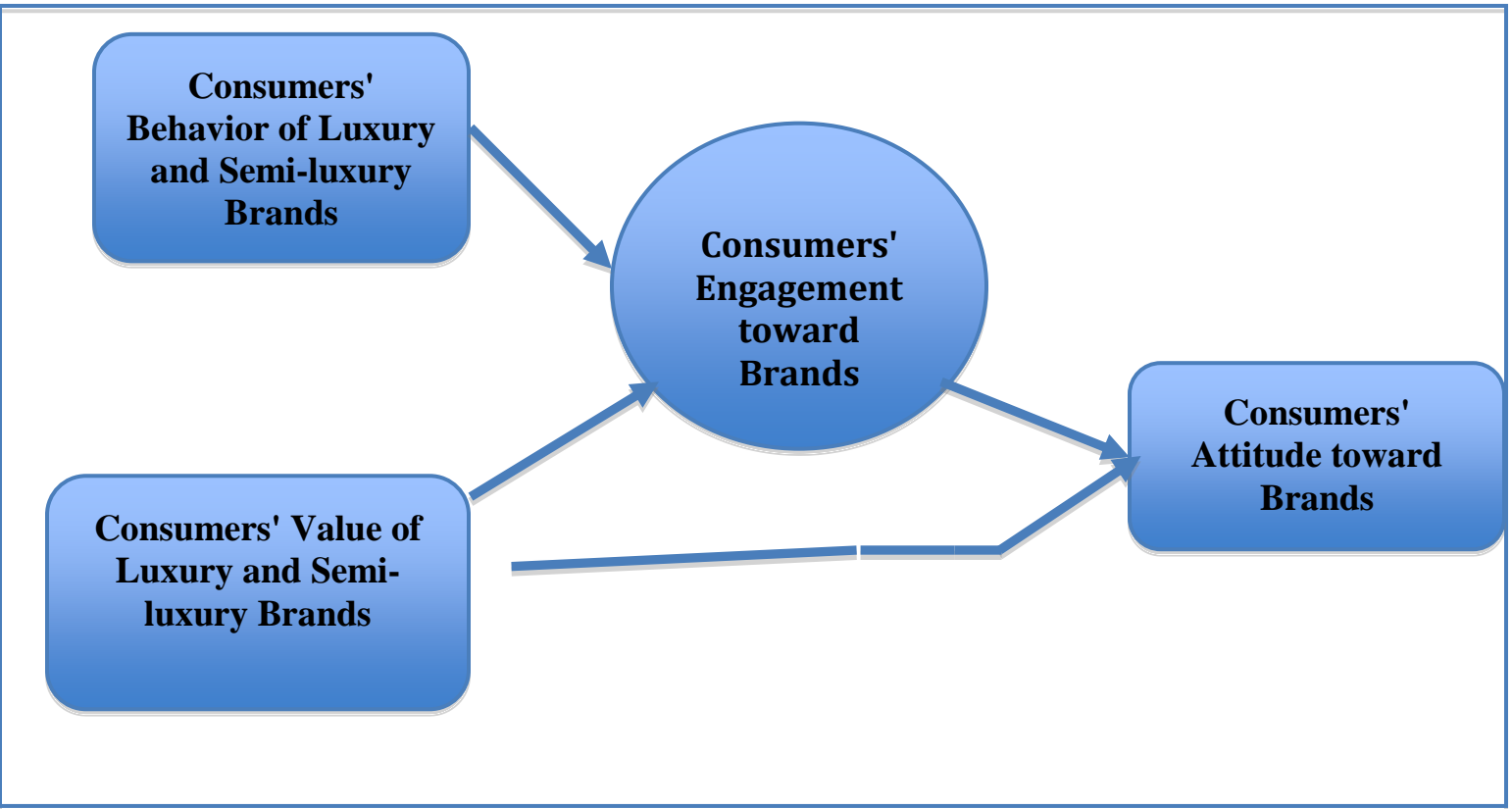
The consumers' perception about brands is caused by the brand recognition and brand's distinctive features such as high quality or trend-setting designs. Due to the emotional attachment towards brands, consumers are more likely to engage in purchasing the luxury or semi-luxury brands. Once the attachment is formed, the consumers' minds and behaviors are influenced by their desire to purchase the product and enjoy the higher levels of satisfaction. Wyner (2003) defined the term "attachment" as "how much the brand has entered the consumer's mind and influenced behavior". It's implied that brand engagement can exist among those who use luxury and semi-luxury fashion brands, and that both feelings and thoughts may be involved. Additionally, supported by the numerous findings, the attitude influences consumer choice. According to the theory of planned behavior, purchase behavior is determined by the purchase intention, which is in turn determined by the attitudes. Luxury brands affect consumer' engagement and make the brands more desirable. Therefore, it can be postulated:

H3: Consumers' engagement toward luxury and semi-luxury fashion brands has a positive effect on consumers' attitudes toward them.

Attitude can be defined as "a learned predisposition to behave in a consistently favorable or unfavorable manner with respect to a given object" (Schiffman and Kanuk, 1997). Regardless of how favorable or unfavorable products are, consumers' can make purchases based on their value consciousness. If there is no preference or attachment in consumers' attitude toward luxury and semi-luxury brands, the intention to purchase a certain product will be based on its monetary or social value, good quality or uniqueness regardless of the brand recognition or brand loyalty. Consequently, the hypothesis is:

H4: Consumers' value toward luxury and semi-luxury fashion brands has a direct relationship toward consumers' attitude.

Figure 2 Conceptual Framework of Consumers' Behavior and Value – Engagement-Attitude toward luxury and semi-luxury brands



4. Methodology

4.1. Procedures

In order to find out what drives consumers to a particular brand, researcher chose a collage approach to gain a visual for what would engage and motivate consumers. The volunteers were asked, “What makes this brand to be called as luxury?”(Creswell 1994; Hall and Rist 1999). Collages bring an interesting aspect to expressing feelings, thoughts, and emotions. They bring light to those “grey areas” of life, and reach areas where words often fall short (Boddy, 2005). Collages can show the thought process and how someone arrived at

a particular place emotionally and psychologically. Often as we tour through our thoughts, we remember things, ideas, places, and feelings by the images from those particular moments; seldom do we ever think of them in words. Overall collages open a more direct form of communicating certain thoughts, ideas, and emotions (Boddy, 2005).

In addition to collages, the second method was conducted. A small group of volunteers were collected and asked a series of questions. Each volunteer was interviewed. One on one interviews are great way to collect data and useful background information on each of the participants. (Ryan, Coughlan and Cronin, 2009). However, the interview is more than a conversational interaction between two people and requires considerable knowledge and skill on behalf of the interviewer. The one-to-one interviewing format consisted of a series of prepared questions that also left room for the subjects to freely respond (Rubin and Rubin, 2005). With the freedom of one-to-one interview questions, the researcher was able to grab more information from each person in a passive aggressive manner; they willingly chose to go in depth on each question, while not knowing that each question was a trap door that was meant to allow them to fall into their minds. One-to-one interviewing allows for valuable information and data to be collected in its purest form, due to the fact that the respondents are answering each question unrestricted and willingly. When analyzing consumers buying habits, crossing paths with their emotions and personal beliefs is inevitable; some volunteers were not completely comfortable disclosing this information in a group setting.

Also, an online survey was conducted in order to collect and analyze consumers' perception towards prototypical brands. Subjects were asked certain questions and given three ads about prototypical brands so that the researcher could identify their way of thoughts and perception of particular products and brands. Online survey is a great tool due to its fast data gathering, not pricey, but with more accurate answers and quicker way to analyze collected data.

4.2 Sample and Data Collection

The collection of data was collected at southern historically black university (HBCU) in United States of America. Twenty-four participants from the focus group and seventeen participants for the small group responded to the experimental questionnaire to be used for research and analysis. The researcher put together a very diverse group to try to have representation of as many gender, race, and ethnicities as possible. By creating a more diverse group, data collected is less likely to be viewed as biased generalization (Pannucci and Edwin, 2010). Each participant was chosen for his or her particular lifestyle, creed, and income status.

To steer each interview into the topics that were most needed for the research, a guide was set in place (Krueger and Casey, 2000). The guide was a strategically assembled array of questions that naturally drove each participant into disclosing more of the information about the topics that were needed, and less of the irrelevant information (Krueger and Casey, 2000); those being interviewed were not made aware of the guide or the complete nature of the questioning.

During the focus group, each participant was asked a series of questions in reference to cars, jewelry, handbags, and perfumes to see how each individual participant perceived each brand or product as luxury or semi luxury. The question was administered for 15 minutes to obtain enough information to analyze. The focus group was asked to create a collage to distinguish luxury and semi luxury products, while the smaller group of volunteers was asked to answer questions pertaining to brands and products freely, to collect accurate data; each one-to-one interview lasted 30 minutes.

There were 73 participants for the online survey regarding the prototypical brands. While analyzing the results it clearly showed that female participants were more than male with 58.90% and 41.10% responses by male respectively. The age range favored to the group of 21-25 with 69.86% that is 51 participants. The second largest age group was in the range of

31-35 with 15.07% that is another 11 respondents. The age in range of 41 and higher scored with 4.11%, while the smallest group of participants was in range of 15-20, which is 2.74%. According to the ethnicity group, the majorities were African Americans that is 53.42%. The other highest group was White (Caucasian) – 17.81%. Asians were 12.33%, African French 6.85%, and the rest of the participants marked as the other.

5. Results

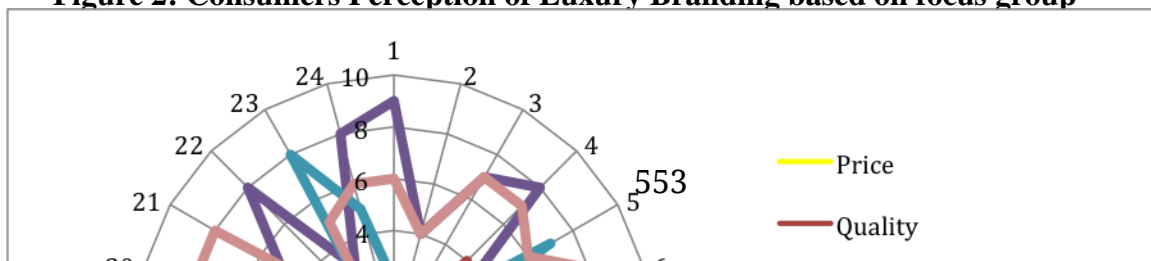
The information collected from the interviews yielded many interesting findings in regards to how each participant perceived certain brands as luxury or semi luxury, while bringing to forefront the different variables that often go into a consumer perceiving a brand as luxury or semi luxury.

5.1 Focus Group

The findings from the focus group appeared to be a reliable source of data to analyze and form an informative assessment of consumers and what drives them to a particular product.

As illustrated on the Figure 2 below, those lines that are closer to the center are most important for consumers’ while shopping. Most participants in the focus group measured Quality as the top driving force when shopping or thinking of a particular brand. The second largest tally as an identification of luxury for consumers was Price. With the third largest group of participants identifying it as a driving force, a brand’s name played a major role for consumers when choosing a particular product, service, or as a brand to identify with. From the data collected, a category – Need to be recognized in peer group ranks last as a motivation factor for consumers, and identifying brand as luxury.

Figure 2: Consumers Perception of Luxury Branding based on focus group



5.2 Small Group

The findings from the one-to-one interviews revealed that most of the respondents viewed luxury as rare oppose to its actual monetary value. The scarcity of an item seemed to be their driving factor in whether to label it as a luxury. In most cases the more rare something is the more people are willing to pay for it (Meffert and Lasslop, 2003). One respondent described luxury as “something rare and scarce.”

Respondents stressed the importance of an item differentiating itself from the everyday items to be considered as luxury. In order for them to consider an item luxurious it must have a certain level of rarity, and the more common it becomes, the less luxurious it is deemed to be (Meffert and Lasslop, 2003). Once luxury items began to lose their scarcity, they start to fall into the category of semi luxury. Semi luxury items are items that have become more of a norm, but not the masses (Gentry, Putrevu and Shultz 2006).

Among the many reasons to purchase luxury items, social acceptance ranked high with many of the respondents (Mick and DeMoss, 1990). Getting the approval of their peers and others around them is their driving force for shopping and as well as other aspects within their lives. The sense of belonging, being sociable acceptable, and as well as having things that seemingly separated them from the “have-nots” in the world is one their top priorities and top motives (Ryan and Deci, 2000). Along with the need for social acceptance, respondents also expressed loyalty towards designers, mottos, and overall missions of certain brands;

consumers love their brands. One of respondents mentioned how she is infatuated with Prada, but due to her financial situation, she treats herself occasionally to Miu Miu, which is also produced by Prada at a more affordable price. It is often seen as semi luxury (Moore and Doyle, 2010).

5.2. Online Survey

An online survey has been conducted to determine prototypical luxury brands of those who have been voluntarily surveyed. In order to collect data and analyze results, four ads were given to volunteers. The first two ads were presenting campaigns of luxury bags for Louis Vuitton and Prada. The other two ad campaigns were about the luxury cars which were: Audi and Mercedes Benz. According to collected results, it clearly shows that consumers' are more aware of Louis Vuitton brand rather than Prada. Even the fact as if it was made in China, consumers' will prefer Louis Vuitton instead of Prada as they love this brand more and its more recognizable for them, therefore making this brand the prototypical luxury brand in terms of bags. As for the cars, the results revealed that there is no big difference in consumers' preferences towards Audi or Mercedes cars. When the volunteers were asked if their next purchase was for Audi or Mercedes, both scored closely same, as consumers' prefer both of the brands. However, they are more aware of Mercedes brand, and surely like it more as its more recognizable for them. Therefore, Mercedes Benz brand is a prototypical luxury car for consumers' in terms of cars. Also, consumers' were aware that these cars are luxury cars and they made in Germany. So there was an interesting outcome from the survey, as if the country of manufacture was China, consumers' prefer more Audi than Mercedes Benz. Theoretically, making an Audi car a semi-luxury car while comparing it to Mercedes Benz, as consumers' will not make a big judgment knowing that country of manufacture is China.

6. Discussions and Conclusion

The purpose of this research was to investigate the consumers' perception toward luxury and semi-luxury brands. Specifically, this study focused on consumers' behavior toward luxury and semi-luxury brands, consumers' value of them, and consumers' engagement and attitude toward luxury and semi-luxury brands.

However, from my focus group study of luxury brands and semi luxury brands, consumers are influenced by an abundant of variables on a daily basis that dictates their perception of a brand. For a brand to be recognized as a luxury brand, often times it must appeal to consumers as exclusive, rare, and trendy (Meffert and Lasslop, 2003). Moreover, the results from an online survey revealed a "bigger picture" of what consumers perceive as a prototype luxury brand. The more brand is recognized in social environment, the more people think that it is a prototype brand in its given category. Therefore, consumers' define prototype brands as luxury brands as they come into their mind first for any given category and consumers' often perceive them as exclusive and extraordinary.

Many consumers like to treat themselves to luxurious items, as a way of coping with whatever life has to give, as well as rewarding themselves for different monumental moments in their lives. Luxury items are often times looked to when choosing something to raise a person's moral (Ryan and Deci, 2000). The value of a particular luxury item depends on a number of variables in that person's life. In some instances, an item that is often seen as semi-luxury may be accepted as a luxury item due to the lack of availability in a given area, and vice versa items that are often seen as luxury items can be seen as semi-luxury due to the everyday nature of an area; an example would be a cozy bungalow in Hollywood, CA as well as that same bungalow in a small cottage community. A consumer's perception of luxury could be influenced by a number of factors including and not limited to social class, gender, race, and demographical location. Those with lower incomes generally find brands that higher

income consumers would generally see as semi luxury or non-luxury, as luxury (Kapferer and Bastien, 2009).

The results of this study should be interpreted with a few limitations. With a small number of participants, it did not accurately illustrate a diverse study population. Related to the characteristics of the sample, some of the dimensions appear to be culturally-bounded, which suggests that a cross-cultural study would bring valuable insights to understanding the cultural issue of luxury perception, luxury fashion brands, and motives to gift oneself with luxury fashion. Limitations could also be seen in the consumer side of the study due to the student population and their average income, or their lack of income. A more diverse and random study population is needed to accurately depict consumers and their relationship with luxury and semi luxury brands. Future research is required to determine a more effective way to measure consumers' perception of luxury and semi-luxury brands. Future research will also focus on how consumers' engagement and attitude toward luxury and semi-luxury brands influences their shopping choices. Future data collection will require a more diversified sub-sample. These changes can help to future research better understand consumers' relationship with brands.

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AN OVERVIEW OF NURSING RETENTION

Anissa Bowers, Valdosta State University, 5086 Falling Springs Rd, Valdosta, GA 31602
618-381-6931, ambowers@valdosta.edu

ABSTRACT

As the American population escalates, especially those aged 65 and over, and the drive for an increased quality of life intensifies, there will be a boosted requirement for qualified nurses within the U.S. healthcare system. Particularly, hospital administrations will face the challenge of attracting qualified nurses and furthermore, have to find feasible ways to retain these nurses. There is an average turnover of 20% in the nursing career field. Attracting and retaining nurses is especially challenging when college and universities are not able to graduate the required numbers of nurses to meet the current nationwide demand; higher numbers in the future will exacerbate the requirements. This research paper identifies factors that are important to registered nurses and their impact on the nurses' intent to remain on the job and in the nursing career field. Hospital leadership must master these elements to recruit and retain a qualified nursing staff.

Keywords: nurses, retention, student, training, faculty, shortage, recruitment

INTRODUCTION

We often hear about the nursing shortage in the United States. This issue is not just restricted to the US; it also impacts other developed countries such as Canada, the United Kingdom and Australia. For the United States, our problem began in the 1990's when hospitals downsized in order to improve efficiencies and lower costs [5]. The downsizing decreased the total number of nurses in the career field and discouraged potential future nurses from pursuing a professional nursing degree. The nursing shortage was exacerbated as those nurses remaining retired. Fewer nurses were available to teach new nurses, and the skillsets for nursing became more technical than previously required.

While our nurses are steadily pacing toward retirement, the baby boomer population is ageing and requiring a larger body of healthcare professionals to support their needs. Additionally, the continuous technological advances in the medical field are allowing Americans to live longer, requiring healthcare professionals who can use and teach technology to those in training as well as teach their patients how to manage their own healthcare with available technical devices. Furthermore, the number of students entering nursing programs is limited due to the lack of qualified faculty to teach. According to the National League for Nursing, reasons for the faculty shortages include disparities in compensation compared to nurses in clinical settings, as well as faculty of other academics, age, and lack of masters and doctoral qualified nurses qualified to teach [11]. Moreover, the Patient and Protection Affordable Care Act, signed into law in 2010, will mandate additional nurses to care for the influx of the newly insured population, thereby worsening an already difficult situation (<https://www.gpo.gov/fdsys/pkg/PLAW-111publ148/pdf/PLAW-111publ148.pdf>). Together, all of these factors contribute to an unbalanced supply and demand, with the end result being a need for more nurses.

In 2000, there was a shortage of 110,000 nurses (six percent of the estimated number needed), according to the U.S. Department of Health and Human Services [5]. The shortage was projected to grow to 12% for 2010 and to 20% by 2020 [13]. If we fail to determine ways to recruit more students into nursing school programs, and have appropriate numbers of faculty to teach them in the schools and retain them in the career field as graduated nurses, the shortage will have a significant impact on the quality of patient care. This paper will look at the best solution to ensure we have enough nurses to meet demands of our future healthcare system based on elements of job satisfaction and their intent to remain on the job and in the career field.

LITERATURE REVIEW

Nursing Population

The healthcare professionals and technicians group is one of the largest occupational groups in the country, with nearly 7.8 million people employed in 2014 [17]. Of this group of healthcare professionals, nurses comprise the largest number. According to the National Sample Survey of Registered Nurses, which has been conducting surveys since 1977, there were an estimated 3.1 million licensed registered nurses living in the United States as of March 2008 [14]. This number represents a net growth of 153,806 nurses from the previous survey in 2004. During this same time period, 2004-2008, 444,668 nurses received their licenses for the first time. However, not all who hold an active license are actually working in a nursing capacity. In 2008, only 84% (2,596,599) of those with active licenses were employed in nursing positions [14].

Nursing Age

Of the estimated 2.6 million actively licensed and employed nurses, a large number of them are closer to retirement age, and thus have fewer years remaining in the workforce. In 1996, the average age of nurses was 44.3 years (retrieved from <http://bhpr.hrsa.gov>). In 2000, the average age increased to 45.2 years. In 2004, the age average grew to 46.8 and there was only a slight increase in 2008 to 47.0 years (retrieved from <http://bhpr.hrsa.gov>). In 2011, the average age of the nursing population was still holding steady at 47 [6]. Although there was only a minor increase in the average age, “nearly 45 percent of registered nurses were 50 years of age or older in 2008,” meaning that high retirement rates are likely to emerge in the near future (retrieved from <http://bhpr.hrsa.gov>).

Nurse Retention

Once nurses are successfully trained and certified, concern turns to retention. Retention requires determining job satisfaction factors to decrease turnover, and thereby increase retention. Nursing turnover is dependent upon a number of factors including pay, working conditions, working hours, professional regard for nursing capabilities, relationships with physicians, and family responsibilities. When considering the number of licensed nurses currently practicing in the healthcare industry and the 50-year-old average age of nurses which is spurring them closer to retirement, we realize actions must be taken to retain as many of these experienced individuals as possible, lure some of them back into the field to train new nurses and to work in healthcare settings in order to maintain high levels of customer satisfaction.

Increased salary alone is not the primary concern for nurses. Retaining good nurses requires creating a positive work environment, lowering patient-nurse ratios, making full use of their capabilities, and allowing more decision-making authority [5]. According to Upenieks (2003), nurses want to feel appreciated and respected. Additionally, nurses want autonomy and inclusion in the decision-making processes concerning patient care. This is a significant departure from the view of nurses as simply being caregivers.

Retention is impacted by the social climate of the workplace to include autonomy, task orientation, and work pressure [1]. Work experience seemed to have an impact on the nurses' perception of these factors. Nurses with five years or less of experience perceived a greater sense of autonomy and a more positive view of tasks being performed than more seasoned nurses [1]. With regard to task orientation, 74% of nurses desired increased staffing, less paperwork and fewer administrative duties [1].

Retention is also impacted by the generation in which the nurses were raised. Brunetto, et al (2013) compared nurses by generations [3]. Although there is varying information about the time period of generational cohorts, these authors ascribe to the definition of the baby boomer generation being those born between 1943 and 1964. Generation Xers were those born between 1965 and 1979, while Generation Yers or the Millennials were born between 1980 and 2000. Generation Y has surpassed Generation X and comprises the largest workforce since the Baby Boomers [9]. This generation is highly adaptable, adept at multi-tasking and can process new information quickly. They are technologically-minded, like to be entertained and bore easily. The baby boomer nurses were most committed to their workplaces, Generation Xers were somewhat committed and Generation Y nurses were between somewhat committed and somewhat uncommitted. As a result, the baby boomer nurses have the lowest turnover intentions while the Generation Y nurses have the highest intention to leave [3]. Therefore, monitoring and improving workplace relationships is an important step in retaining skilled nurses.

As cited by Skillman, S., Palazzo, L., Hart, L., & Keepnews, D. (2010), job dissatisfaction is the primary reason licensed registered nurses do not retain employment in the nursing field. Job dissatisfaction includes job-related stress, personnel issues with colleagues and supervisors and patient safety issues [12]. There are many ways to determine what is important to nurses and to gather data about these concerns. However, literature suggests nurses worry most about 1) their own health; 2) the well-being of their patients; 3) autonomy; and 4) work schedules. Salary is not a major factor.

Salary

Often times we think money is what will make employees happy and committed to a job. According to the U.S. Department of Labor's Bureau of Labor Statistics, occupational employment and wages for 2014 showed that nurses earned a mean annual average of \$69,790. This national average excluded nurse anesthetists, nurse midwives and nurse practitioners (retrieved from <http://www.bls.gov/oes/current/oes291141.htm>). The literature does not yield much information about nurse job satisfaction in relation to salary. Most of the documented and researched concerns regarding retention do not deal with salary, but non-tangible concerns.

Nurses Personal Health

When the hospitals reduced budgets in the early 1990's, many nursing positions were eliminated. The nurses who remained were left with more work demands which led them to be more physically and emotionally exhausted than they were before [16]. Not only did the workload increase, but the introduction of new technologies over the years challenged nurses to learn new skills. Those unable or unwilling to adopt and use new technologies left the field, further reducing the number of available nurses. Therefore, a threat to nurse retention is the persistent problem of under-staffing and poor skill base of those remaining on the job [4].

The mental and physical safety of nurses is important not only to protect the health and well-being of the nurse, but also to protect the health and well-being of the patient. There are many types of workplace stressors which impact the safety of the nurses. One example of workplace stressors is working within organizations with downsized staffs. Organizations operating without adequate staffing to meet patient requirements create more stress for the remaining nurses. A nursing shortage requires nurses on duty to work at a faster pace due to a larger patient-nurse ratio. Shortages also require them to work longer hours than the long shift hours they already work. Nurses are unable to go home until their relief is on the job. These longer hours may impact their quality of life, deprive them of sleep, exercise and eating proper meals. Some nurses even deal with stress by drinking and smoking (Han, K. et al, 2012). The shortage can further exacerbate the stress of the permanent nurses when temporary nurses are used to fill in the gaps. The requirement of the permanent nursing personnel to continually train the temporary nurses adds additional mental stress.

Other short term physical stressors include musculoskeletal injuries, often resulting from lifting patients, and infections. Those in the healthcare profession are at a greater risk of musculoskeletal injuries than most other professions except for construction. The high risk of musculoskeletal injuries, especially back injuries, leads to sick days, disability and turnover [15]. Over the long term, documented physical stressors include cardiovascular, metabolic and neoplastic diseases [15]. Not much current research has been conducted, but a Minnesota Nursing Association 12-hospital study of illness and injury data between 1990 and 1994 found that when there was a nine percent decrease in nursing staff, there was a 65% increase in injuries [15]. Findings from another study indicated that sprains and strains have a direct impact on retention [2].

According to the U.S. Department of Labor's Occupational Safety and Health Administration, 250,000 work-related injuries and illnesses reported in U.S. hospitals in 2012 required almost 60,000 of those employees to miss work. It is not known how many of the injuries were specifically for nurses. However, the estimated cost to the hospitals was a whopping \$2 billion in nationwide workers' compensation losses.

Patient Well-being

Increased workload pressures not only threaten the health of the nurses left behind to handle the patient load, it also impacts the quality of patient care. A nursing shortage limits the amount of time a nurse is available to care for each patient, and it also limits the time a nurse can collaborate with other team members about the well-being of patients [3]. Nurses operating in environments where there is a shortage of available nurses are working longer hours, have more patients to care for physically and administratively, and are therefore more likely to make administrative and medical mistakes. At worse, these missteps may be deadly for the patient and financially impact the organization in the event of a lawsuit.

Nursing shortages can also lead to deliberate violations of protocols and policies in order to more quickly get the job done and may sometimes compromise patient safety. This may happen when the nurse is under pressure such as an emergency situation or under a heavy workload such as understaffing.

Quality patient care is important not only for the importance of the individual patient and the moral satisfaction of the nurse, but also for the financial reimbursement of the organization. Medicare reimbursements to hospitals are now partially based on patient satisfaction measurements [8].

Autonomy

One way to meet the seemingly ever-growing nursing demand is by retaining the ones who are already practicing. Job satisfaction is what keeps nurses around and autonomy contributes to job satisfaction. According to Weston (2008) autonomy is defined as “the ability to act according to one's knowledge and judgment, providing nursing care within the full scope of practice as defined by existing professional, regulatory, and organizational rules [18].” Nurses seem to want more autonomy, specifically with regard to the physician-nurse relationship. Nurses are the individuals who care for the patients most hours of the day and night, whereas the doctors normally only visit the patients in the hospital once a day for a few minutes. This close working proximity to the patient begs for the nurse to be able to make certain decisions, within legal and ethical bounds, about patient well-being without obtaining a physician's permission each time.

Work Schedules

Nurses work in a variety of settings and varied shifts. However, the majority of nurses work in hospital settings and work an average of 12 hours per shift. When there is a nursing shortage within an organization, the hours worked per shift or the days worked per week are increased. Some hospitals have such a chronic problem with nursing shortages that overtime is the rule rather than the exception. In a study of Washington state nurses with expired licenses, respondents stated that the availability of flexible work hours would cause them to reconsider entering the nursing workforce [12].

DATA COLLECTION

Extensive research is available in the nursing field regarding various subjects covering generalized to specialized nursing concentrations. There is research about the turnover, retention, recruitment and job satisfaction of nurses. To answer the question of what is the best solution to ensure we have enough nurses to meet the future demands on the healthcare system, a nationwide study is appropriate. The study should include participants from all three generations that are currently working in the nursing field. Each generation has a different learning style and different expectations about the work environment, and all these factors need to be considered.

The study should also include what their life is like outside of the work environment. Organizations need to treat employees as a whole person and not just a person who comes to work and has no life stressors that impact the workplace and their desire to work. Organizational culture is a promising area to research for a better understanding of options to reduce employee turnover [10]. It would also be necessary to collect data on their perception of the organization's culture and its impact on the mission and patient safety.

A little-researched implication for nurse turnover is moral distress. Nurses consistently facing moral decisions and feeling distressed about it are less effective at accomplishing their duties. When nurses, particularly new nurses, feel unprepared to manage ethical issues there are more

likely to leave the position and sometimes the profession [19]. More research should be conducted in this area.

Additionally, the study should include data mining for learning specifically why the individuals entered the nursing field, what has compelled them to remain in the industry and what would prompt them to leave the industry. Also, since there needs to be a steady flow of nurses into the career field to replace retiring nurses and to care for the larger influx of patients due to the population living longer and newly insured population seeking healthcare, there should be questions about nurses serving as faculty if not desiring to serve in the clinical aspect of nursing. A more pointed, yet important question to ask is if they are currently planning to leave the nursing career field, and if so when and why.

Information gathered could be used to satisfy the question of what is necessary to retain America's currently licensed registered nurses. Furthermore, this information could easily be used to identify ways to recruit individuals into the field of nursing.

DISCUSSION

No career field is immune to turnover and that includes the nation's largest group of employees in the healthcare industry—nurses. We would be remiss in not realizing there is a continuing threat to the healthcare industry, especially as the ageing nurse population starts to enter the retirement stage and the number of needed nurses coming into the pipeline is threatened due to the lack of qualified faculty to teach them. The recruitment of new nurses is something the healthcare industry must be concerned about now, and not wait until waves of nurses start retiring. Nurse recruiters suggest networking with colleges, high schools and even middle schools to get more students interested and into the nursing pipeline [5]. Another tactic is for hospitals to offer a summer camp for middle school students and a paid summer externship for college nursing students [5].

Hospital nurse executives attribute the shortage of the predominantly female nursing field to nurses having more opportunities outside of the healthcare field [16]. It is surmised that they searched for these opportunities because they were dissatisfied with their careers in the nursing field. There are far more jobs available to women in other career fields than in the 1990's prior to the nursing drawdown. In many instances these jobs offer better and more flexible working hours, and better pay. Ways to eliminate the guessing game of what nurses desire to keep them in the career field is simply to ask them. Among the options are surveys and exit interviews. Some of the top concerns for nursing professionals is training, supervisor support, and teamwork.

However some repeated themes that have been uncovered in the research is the nurses' desire for more flexible hours, autonomy and better nurse-physician relationships, and stronger collaboration with colleagues. Factors that nurses would like to avoid and therefore encourage retention are the exhaustion and stress of the job which is usually caused by a large patient to nurse ratio. They would also like to avoid the physical pitfalls of nursing which can often lead to missed days from work, disability and other long term diseases.

From this information, we realize that understanding the job satisfaction of those entrusted to care for us and our loved ones on a daily basis is quite complex; therefore the solution of retaining these individuals is just as complex. There are basics that can be applied across the

board such as introducing ergonomic ways for nurses to avoid the pitfalls of injuries. Another way is the development of rules of engagement to offer nurses more autonomy and more decision making authority when it comes to the care of the patient, especially since the nurses are the ones spending the most time with the patients as opposed to the physicians. Other recommendations to reverse the trend include referral bonuses, enhanced respect and recognition, improved communication between management and staff, and more professional development opportunities.

There are some retention aspects that may be more specific to the organization and the demographics of the nurses serving in the organization. One such example is an organization with a large population of older nurses who may also be caring for elderly parents. Another example is a large population of nurses with young children. Offering elderly care and onsite child care, is a great employee benefit which will likely aid in retention. The same applies for work hours; depending upon the lifestyles and commitments of those within an organization, more flexible hours will contribute to a higher retention rate.

Additionally, if the organization could offer overtime as an exception and not the rule, those who do not want the extra hours will be satisfied. For those preferring the opportunity to earn the extra money, overtime still offers them the opportunity to do so. For example, a single nurse with no family commitments and student loans may desire overtime to make extra money to pay off debt sooner. Conversely, a nurse with a family may prefer not to work overtime, but prefer to spend more quality time with a growing family.

One particular area that must be researched more thoroughly is the recruitment and retention of the Millennials. There is limited research about what attracts and thus may retain the largest workforce in America. Major efforts must be made to recruit and retain this powerhouse of working age adults. Perhaps a fast-track model of completing nursing requirements can be instituted to utilize their fast learning and tech savvy skills [9].

Magnet hospitals are touted as having a more positive impact on nurse perception and satisfaction than other hospitals. Characteristics of magnet hospitals include providing career opportunities in three primary areas: administration, professional practice, and professional development. Administration includes clinic career opportunities, flexible working schedules, adequate nurse staffing, decentralized organizational structure, and qualified nurse executives. The professional practice aspect includes autonomy and responsibility, models of delivery of care, availability of specialist advice and emphasis on teaching responsibilities of staff. Professional development characteristics are management development, competency-based clinical ladders, planned orientation of staff, and emphasis on service/continuing education [16].

CONCLUSION

Nurse turnover was above 20% in 2000 [1]. The cost for turnover is up to two times of the nurse's salary. The hidden cost of nurse turnover is "patient mortality, drug errors, and infection rates" [3]. Retention is a complex problem; there is not one single solution to solving this issue in the U.S. or even on the worldwide stage of the career field. Studies also suggest retention is more directly related to the job and not as much to the life stage of the registered nurse [2]. We know retention cannot be eliminated, but it can certainly be influenced. Multiple points of intervention exist and must be addressed to retain highly qualified nurses in the workforce. If not, patient quality will greatly suffer.

Happy work environments with manager support, inclusive decision-making, nurse recognition and respect are all associated with increased nurse retention, reduced staff turnover, and increased job satisfaction [8]. Other recommendations to retain nursing staff or acquire additional nursing support are to hire temporary nurses, and foreign nurses, to offer training opportunities, tuition assistance, and loan forgiveness [5].

The ideal situation to retain nurses is one in which all nurses are satisfied with supervisor and colleague relationships considering this would lead to more sharing of time and knowledge with one another [3]. This in turn will likely lead to higher comradery, decreased stress and a positive perception of their well-being and also commitment to the organization [3]. The best model to incorporate most elements of nurse job satisfaction and intent to remain on the job is the magnet hospital. Organizations struggling to overcome understaffed nursing positions need to consider this model. This option coupled with additional research will certainly improve retention and therefore decrease nurse turnover and provide the healthcare industry with the nurses required for our ever-growing population of American citizens and undocumented residents with medical needs.

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